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1975

MODEL 1700A

DISTORTION MEASUREMENT

SYSTEM

FLUKE CAL LAB

SOUND TECHNOLOGY

MODEL 1700A

DISTORTION MEASUREMENT

SYSTEM

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1400 Dell Avenue
Campbell, California 95008
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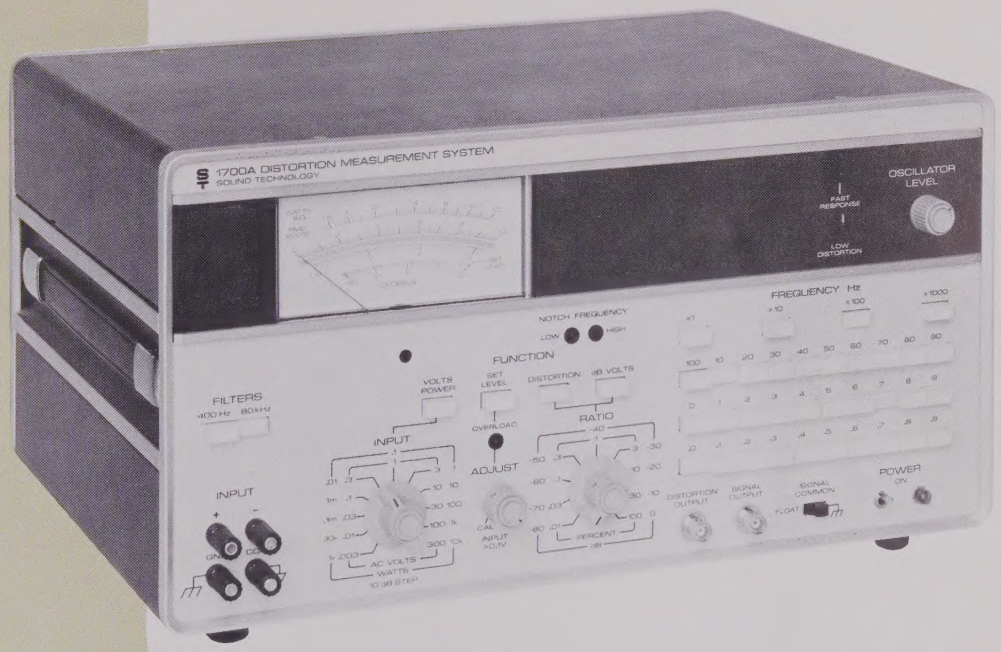
January, 1975

MODEL 1700A

DISTORTION MEASUREMENT SYSTEM



A distortion analyzer and oscillator simultaneously tuned in one fast and easy-to-use system.

- Use the .001% distortion oscillator for testing from 10 Hz to 110 kHz.
- Measure distortion down to .002% in less than 5 seconds.
- Fully automatic nulling eliminates balance controls.
- Measure ac voltage 30μV full scale to 300V full scale with 2% accuracy.
- Measure voltage or signal-to-noise ratios with 100 dB dynamic range.
- Measure power across 8Ω.
- Differential input measures floating or balanced sources, reduces ground loop and noise pickup.

SOUND TECHNOLOGY
1190 Unit G
1400 DELL AVENUE
CAMPBELL, CALIFORNIA 95008
(408) 378-6540

MODEL 1700A

Distortion Measurement System

Replica of input signal, referenced to ground, always available at rear panel.

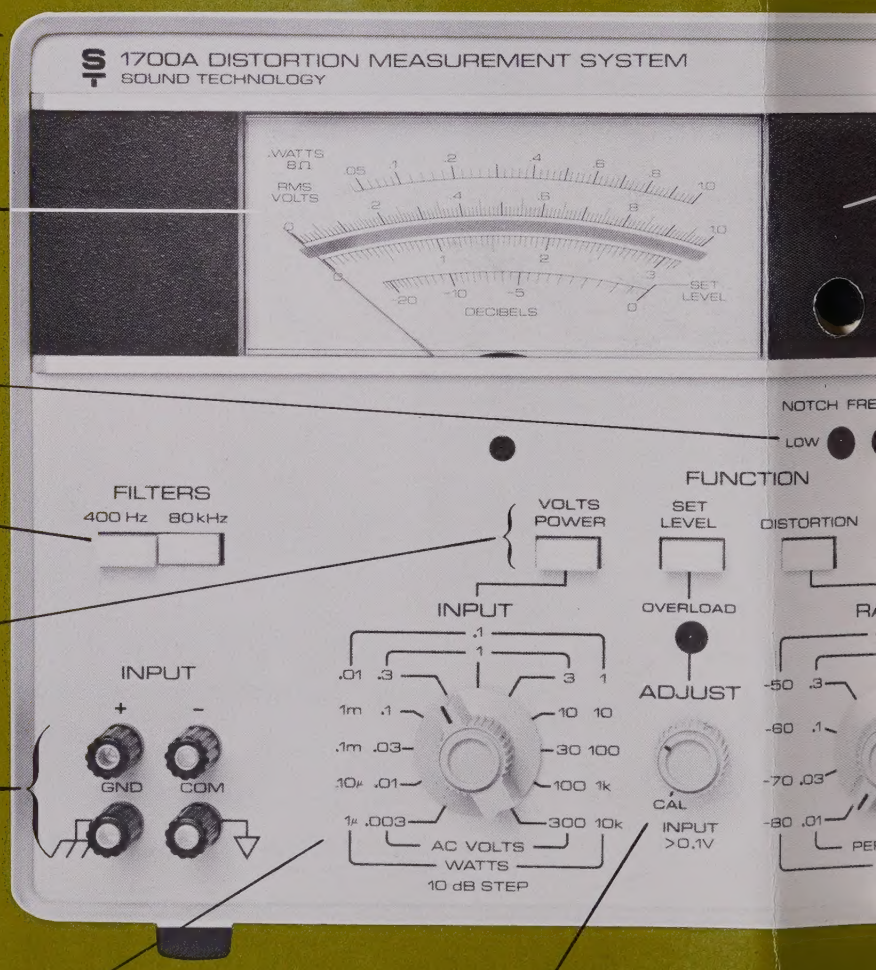
0.5% taut band meter monitors voltage, power, distortion or dB ratio.

Tuning indicators help you when measuring distortion of an external source.

Selectable 18 dB per octave filters reject hum and high frequency noise.

Fast pushbutton operation lets you set level, measure voltage or power, then measure distortion — no range changing required.

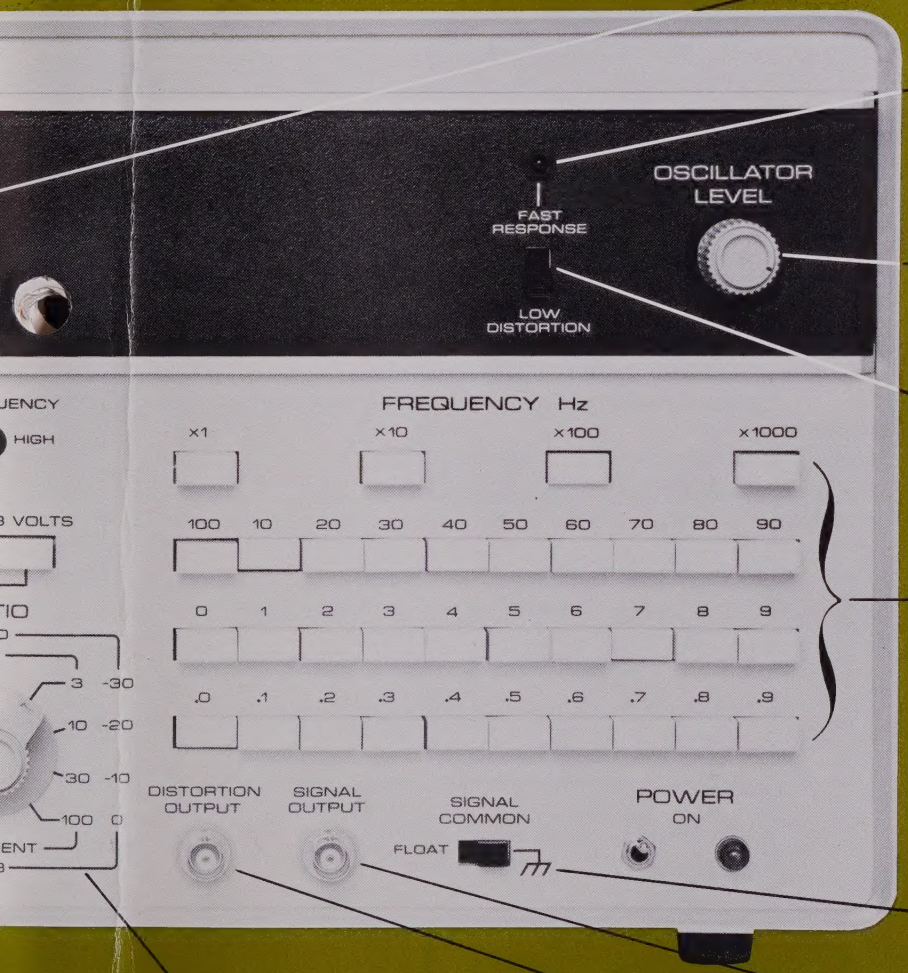
Differential Input lets you measure strapped amplifiers or amplifiers with floating outputs, breaks ground loops.



Measure voltage or power from 10 Hz to 110 kHz. Accuracy on voltage is 2%.

Set 100% reference level on signals from 300V down to 0.1V.

- ★ *Measure .002% distortion in less than 5 seconds.*
- ★ *Measure ac voltage with 2% accuracy.*
- ★ *Measure ratios with 100 dB dynamic range.*
- ★ *Measure power across 8Ω.*
- ★ *Ultra-low-distortion 10 Hz to 110 kHz oscillator.*



No manual nulling controls are required — the 1700A is always in auto-null, reaches a null in less than 5 seconds.

Oscillator distortion is typically .001% in low-distortion mode.

Internal oscillator provides the test signal. Level adjusted with log pot.

Switch lets you choose ultra-low-distortion *(less than 5 sec. settling time)* or fast response operation.

Simultaneously select oscillator and analyzer frequency with fast-to-use pushbuttons. Range is 10Hz to 110 kHz

Switch isolates signal ground from chassis ground, breaks ground loops.

Oscillator output level variable from less than 1mV to 3V.

Distortion products are continuously available for scope viewing — even when the meter is reading input power.

Measure distortion down to .002%, voltage or signal to noise ratios with 100 dB dynamic range, extend voltage measurement capability to 30μV full scale.

Specifications

TOTAL HARMONIC DISTORTION MEASUREMENT

Fundamental Frequency Range: 10 Hz to 110 kHz in 4 overlapping ranges with 3 digit resolution. Distortion analyzer is tuned simultaneously with oscillator.

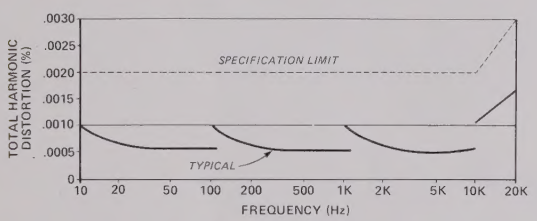
Input Voltage for 100% Set Level: 0.1V to 300V

Distortion Range: .01% to 100% full scale in 9 ranges

Distortion Measurement Accuracy Including Autonull Error for Harmonics to 300 kHz:

Fundamental Frequency	2nd through 5th Harmonic Accuracy
10 Hz – 20 kHz	±1 dB
20.1 kHz – 50 kHz	±2 dB
50.1 kHz – 110 kHz	±3 dB

Residual Distortion:



Above 20 kHz, residual distortion is .007% to 30 kHz, <.02% to 50 kHz, <.05% to 80 kHz, <.1% to 100 kHz.

Noise: If distortion products of the signal under analysis are significant, residual noise will be reduced by the average responding meter. Worst case noise (80 kHz filter in) is .0025% to 10 kHz, .003% to 20 kHz with the measured signal greater than 0.3 vrms. At lower signal levels the noise spec of the voltmeter applies.

Fundamental Rejection: > 100 dB

Input Impedance: 100 kΩ shunted by < 100 pf, balanced to ground

Distortion Output: At least 31.6 mV rms for full scale meter deflection. Output impedance is 1 kΩ.

Voltmeter AC Output: A ranged reproduction of the input signal is available on the rear panel.

Automatic Null: Operates on all distortion ranges. Automatic null time < 6 sec when used with internal oscillator.

Meter Response: Meter indication is proportional to average value of waveform.

Frequency Calibration Accuracy: Better than ±2% of selected frequency.

Common Mode Rejection: > 40 dB at 60 Hz with SET LEVEL ADJUST fully ccw, decreasing to 25 dB with control cw.

Maximum Common Mode Voltage: Not to exceed input voltage range setting or 1V, whichever is greater.

Input Filters:

Low Pass: 3 dB point at 80 kHz with 18 dB/octave rolloff. Normally used only with fundamental frequencies < 20 kHz.

High Pass: 3 dB point at 400 Hz with 18 dB/octave rolloff. 60 Hz rejection > 40 dB. Normally used only with fundamental frequencies > 400 Hz.

VOLTAGE/POWER MEASUREMENT

Frequency Range: 10 Hz – 110 kHz

Input Range: 3 mV to 300V full scale (1 μw to 10 kw across 8Ω) in 11 ranges. Full scale resolution can be extended to 30 μV using RATIO switch.

Input Impedance: 100 kΩ shunted by < 100 pf, balanced to ground.

Voltage Accuracy: ±2% 20 Hz – 20 kHz,
±5% 10 Hz – 110 kHz

Extended Voltage Range Setup: To obtain sensitivities as high as 30 μv full scale, select dB VOLTS, ADJUST control fully ccw, INPUT switch on .3V range.

Residual Noise: < 8 μv with 80 kHz filter in,
< 15 μv with 80 kHz filter out

Power: Power scale converts voltage reading to power across 8Ω.

Common Mode Rejection: > 40 dB

Maximum Common Mode Voltage: Same as above

Voltmeter AC Output: Same as above

RATIO MEASUREMENT

Voltage measurement specifications apply with the following additions:

Input Voltage for 0 dB Set Reference: 0.1V to 300V

Accuracy: ±0.2 dB 20 Hz – 20 kHz,
±0.5 dB 10 Hz – 110 kHz

OSCILLATOR

Frequency Range: 10 Hz to 110 kHz in 4 overlapping ranges with 3 digit resolution. Oscillator is tuned simultaneously with distortion analyzer.

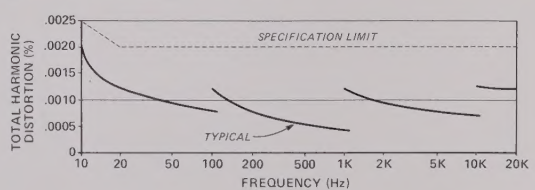
Frequency Accuracy: ±2% of setting

Frequency Response: Flat within 0.2 dB

Output Voltage: Variable 1 mV to 3V with single turn logarithmic pot

Output Impedance: Variable up to 625Ω

Distortion in Low Distortion Mode:



Above 20 kHz, distortion is < .007% to 30 kHz, < .02% to 50 kHz, < .05% to 80 kHz, < .1% to 100 kHz.

Distortion in Fast Response Mode: < .05% 100 Hz – 50 kHz,
< .2% 20 Hz – 110 kHz

Hum and Noise: 100 dB below rated output

GENERAL

Dimensions: 17.2 inches wide, 8.7 inches high, 12 inches deep.

Power: 115V ±10%, 50 to 60 Hz, 18W
220V optional at no charge

Weight: 16 lbs.

Shipping Weight: 21 lbs.

Model 1700A Option 001 (no oscillator)
Model 1700A Opt. 002 Rack mount

All prices f.o.b. Campbell, California — data subject to change without notice.

WARRANTY

All new Sound Technology products are warranted against defects in materials and workmanship for one year from the date of delivery. Any instrument or component that is found to be defective within the warranty period after examination by Sound Technology or an authorized representative thereof will be repaired or replaced without charge for labor or material. No other warranty is expressed or implied. We are not liable for consequential damages.

Before returning a product to Sound Technology for service, authorization must be obtained from the factory. For products not covered by the warranty, a purchase order should be forwarded to avoid unnecessary delay. Please include instrument model number and serial number with all requests for parts or service to facilitate the fastest possible response.

All products returned to the factory must be shipped prepaid. For products under warranty, Sound Technology will pay for shipment back to the customer.

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SECTION I
OPERATION

1-1. SCOPE OF SECTION

The section contains information and instructions necessary for the operation of the Sound Technology Model 1700A Distortion Measurement System. Included are power requirements, cabling information and operating instructions.

1-2. INTRODUCTION

The Model 1700A Distortion Measurement System combines an ultra-low distortion oscillator, a high-resolution automatic-measuring distortion analyzer, and an accurate ac voltage/power meter in one instrument. Pushbutton operation permits the operator to quickly measure voltage or power, set level, and then measure distortion.

The oscillator section provides a pure sine wave signal for testing from 10 Hz to 110 kHz. Amplitude is variable from 3 volts to less than 1 mV.

The analyzer section contains a tracking notch filter which is always tuned to the oscillator frequency. The analyzer measures total harmonic distortion with a sensitivity ranging from 100% to .01% full scale, with automatic nulling on all ranges. Active filters may be selected for low frequency and high frequency noise suppression, enhancing the measurement resolution. A differential front end rejects common-mode noise.

The ac voltage/power meter inherent in the analyzer measures ac voltage, or power across an 8-ohm external load. The measurement range for ac voltage is 3 mV to 300 V full scale (30 μV to 1 mV in Extended Range Para. 1-16) and for power is 1 μW to 10 kW full scale. Voltage ratio measurements with a 100 dB or more of dynamic range can also be made.

1-3. INPUT POWER REQUIREMENTS

The Model 1700A System may be operated from either a nominal 115-volt or 230-volt, 50 to 60 Hz power source. A two-position selector switch on the rear panel selects the power source. Before connecting the instrument to the power outlet, check that the selector switch setting matches the nominal line voltage of the source.

The Model 1700A System is protected from ac power overloads by a fuse (1A, fast-blown) located in a cartridge-type fuse holder on the rear panel.

1-4. POWER CABLE

The International Electrotechnical Commission (IEC) recommends that instrument panels and cabinets be grounded to protect operating and servicing personnel. The Model 1700A system is equipped with a three-conductor power cable assembly which, when plugged into the appropriate outlet, grounds the unit through the round offset pin.

1-5. CONTROLS AND INDICATORS

The data sheet at the front of the manual illustrates and describes briefly the Model 1700A Distortion Measurement System's front panel controls and indicators. The following provides additional explanatory information:

a. POWER ON switch connects ac power to Model 1700A System. Pilot lamp glows when instrument is turned ON.

b. +INPUT and -INPUT terminals -- Provide connections for signal being measured.

c. GND (⏚) terminal -- Provides connection to chassis ground.

d. COM (⏚) terminal -- Provides connection to circuit common.

e. VOLTS/POWER pushbutton -- Selects Volts or Power measurement function.

f. INPUT switch -- Selects full scale meter range for Volts or Power measurement function. Readings are in volts rms or watts.

g. OVERLOAD indicator -- Indicator is lit when input signal overloads input buffer. This warns operator that Volts or Power measurement is no longer accurate.

h. SET LEVEL pushbutton -- Selects Set Level function whereby meter displays reference signal level for Distortion or Ratio measurement.

i. SET LEVEL ADJUST -- Adjusts reference signal level for Distortion or Ratio measurement. When control is set to CAL position (max. counterclockwise), RATIO ranges extend voltage measurement capability to 30 μV full scale (Paragraph 1-16).

j. DISTORTION pushbutton -- Selects Distortion measurement function.

k. dB VOLTS pushbutton -- Selects Ratio measurement function.

l. RATIO Switch -- Selects full scale meter range for Distortion and Ratio measurement functions. Readings are in percent or dB.

m. NOTCH FREQUENCY indicators -- Facilitate tuning when using an external oscillator. When LOW indicator is lit, Model 1700A System frequency is low with respect to incoming signal, when HIGH indicator is lit, Model 1700A System frequency is high with respect to incoming signal. System is correctly tuned when both indicators are extinguished.

n. SIGNAL COMMON switch -- Switches circuit common from chassis ground, breaking ground loops. FLOAT position floats (disconnects) circuit common of System from chassis ground; Chassis Ground ($\frac{1}{\pi\pi}$) position connects circuit common of System to chassis ground.

o. FILTERS -- 400 Hz pushbutton selects a filter which suppresses low-frequency noise (such as 60 Hz hum) below 400 Hz. 80 kHz pushbutton selects a filter which suppresses high-frequency noise above 80 kHz. The 80 kHz filter also reduces effects of AM radio station pickup. Both filters affect meter reading only on Distortion and Ratio measurement functions. They do not affect meter reading on Volts/Power, and Set Level measurement functions. The 400 Hz filter is usable with fundamental frequencies down to 400 Hz when making distortion measurements.

p. METER -- Indicates signal level of measurement selected by Function pushbutton.

q. DISTORTION OUTPUT BNC connector -- Provides distortion product of signal being analyzed (suitable for viewing on oscilloscope) on Volts/Power, Set Level, and Distortion measurement functions. On Ratio measurement function, this output provides a scaled version of input signal. Output is 31.6 mV full scale.

r. FAST RESPONSE/LOW DISTORTION switch -- Selects operating mode of oscillator. FAST RESPONSE causes oscillator amplitude to settle quickly after a frequency change. This mode is recommended when ultra-low distortion measurements are not required, for example when making frequency response measurements. LOW DISTORTION selects full ultra-low distortion capability of oscillator. The settling time in this mode is less than 5 seconds. Actuation of FREQUENCY pushbuttons generally causes oscillator to go first to FAST RESPONSE mode and then to settle in LOW DISTORTION mode. This switch controls only the oscillator and is not connected to the distortion analyzer.

s. FAST RESPONSE indicator -- Indicates operating mode of oscillator. When lit, oscillator is in Fast Response mode and does not have ultra-low distortion.

t. FREQUENCY pushbuttons -- Simultaneously select oscillator and distortion analyzer frequency. Four Multiplier switches and 30 Digit switches permit 3-digit resolution within each range. Frequency range of Model 1700A System is 10 Hz to 109.0 kHz. One button in each row must be depressed at all times.

u. OSCILLATOR LEVEL control -- Adjusts amplitude of oscillator. Level is variable from 3 volts to below 1 millivolt. Control is single-turn logarithmic potentiometer.

v. SIGNAL OUTPUT BNC connector -- Provides oscillator output signal. Output impedance varies with setting of OSCILLATOR LEVEL control and reaches a maximum of 625 ohms at mid-range.

w. BUFFERED INPUT SIGNAL BNC connector (located on rear panel) -- Provides replica of input signal being analyzed. This signal is referenced to ground and intended to be connected to an oscilloscope.

1-6. TEST SETUP

In order to take full advantage of the unique ultra-low distortion measuring capabilities of the Model 1700A System it is extremely important that the cabling between the Model 1700A, the amplifier under test, and other test equipment be connected in compliance with the arrangement shown in Figure 1-1 and described in the following paragraphs. The connections and controls numbered in Figure 1-1 are similarly identified in the test. These connections have been found to provide the optimum test setup in most cases.

1-7. POWER CONNECTIONS

a. Check that power slide switch on rear panel of Model 1700A is set to correct position for available ac power (see Paragraph 1-3 for details).

b. Do not float the earth ground lead of the power cord of the Model 1700A. (The differential input makes this step unnecessary for breaking ground loops.)

c. Plug the Model 1700A, amplifier under test and the oscilloscope (if used) closely to each other into the ac power bus.

1-8. GROUND CONNECTIONS

a. Connect Model 1800A GND (⏚) terminal (1) to ground terminal (chassis ground) of amplifier under test.

NOTE

This reduces common mode 60-Hz potential differences and provides a path to ground for 60-Hz current that may be injected into the chassis of the amplifier under test from its own primary power circuits.

b. Connect oscilloscope (if used) to BUFFERED INPUT SIGNAL BNC connector (2) on rear panel of Model 1700A via cable (3).

NOTE

1. This output is from the differential to single-ended converter in the Model 1700A which provides a replica of the input signal. This signal is referenced to ground.

2. If a BNC cable is not used for this connection, the oscilloscope common (low) terminal must be returned to the Model 1700A System GND (⏚) terminal (1) via a direct connection (4).

c. This completes the ground connections necessary for proper Model 1700A operation.

1-9. SIGNAL CONNECTIONS

CAUTION

CONNECTING OSCILLATOR OUTPUT TO A HOT CHASSIS MAY BLOW FUSE, F2.
(Fuse located on bottom of instrument. A blown fuse will make FLOAT switch ineffective and cause hum problems.)

DO NOT EXCEED THE INPUT VOLTAGES LISTED BELOW TO PREVENT BLOWING F101 AND F102.

With Input Range Switch -- 3 V and Lower.
1. 300 B Below 60 Hz
2. 50 V Above 1 kHz

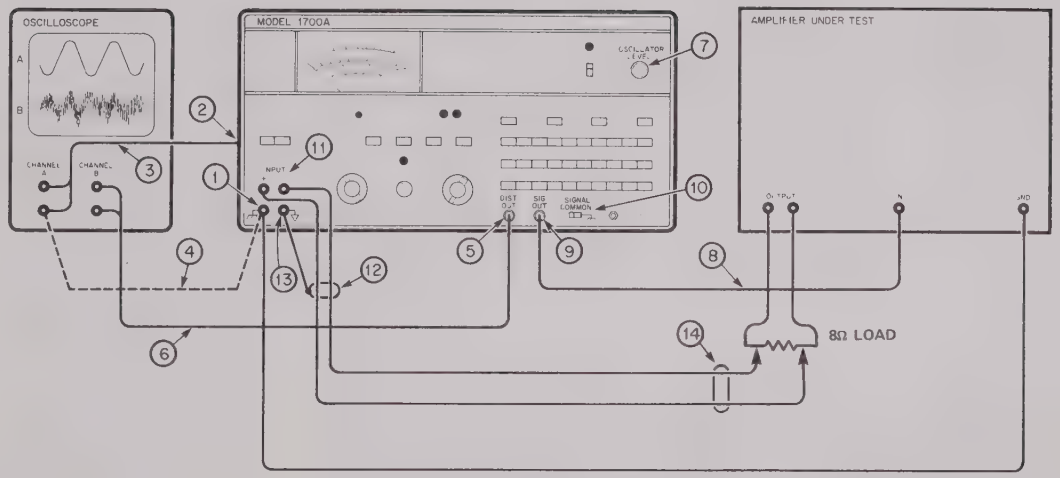


Figure 1-1 Model 1700A Test Setup

a. Connect oscilloscope (if used) to DISTORTION OUTPUT connector (5) via cable (6). This permits monitoring the distortion products of the signal being analyzed.

NOTE

The shell of the DISTORTION OUTPUT BNC connector is returned inside the Model 1700A System to circuit common through a 1 μF capacitor. The shell of the rear-panel BNC connector is at chassis ground. The above connections place this 1 μF between the Model 1700A System circuit common and the chassis when using an oscilloscope. This permits reasonably noise-free viewing of the waveforms while still retaining a considerable amount of immunity to ground loop currents flowing between the Model 1700A SIGNAL OUTPUT and the input of the amplifier under test.

b. Turn OSCILLATOR LEVEL control (7) fully counterclockwise (minimum level).

c. Set gain control on amplifier under test to its lowest setting.

d. Connect cable (8) between SIGNAL OUTPUT BNC connector (9) and input of amplifier under test.

e. Set SIGNAL COMMON switch (10) to FLOAT.

NOTE

This achieves the ultimate rejection of unwanted power-line related noise (especially in the leads of the input of the amplifier under test). With no other equipment such as an oscilloscope connected to the system, there is only a nominal .001 μF of capacitance between the System circuit common and chassis ground. The corresponding reactance, greater than 2 megohms at 60 Hz, effectively opens the ground loops between the Model 1700A and the amplifier under test.

f. Connect output of amplifier under test to a suitable 8 ohm load resistor. (Load resistor should be in a location free from any ac magnetic field, such as caused by a power transformer, to avoid hum pickup).

g. Connect signal to be measured (voltage developed across 8 ohm load) between +INPUT and -IMPUT terminals (11). Use shielded twisted-pair cable for this connection and keep test leads as short as possible to avoid extraneous pick up from stray ac fields.

h. Connect shield (12) of input wiring to COM (⏚) terminal (13). Leave shield (14) at other end unconnected.

NOTE

1. The input terminals do not have a polarity (as indicated) for ac and may be connected either way with no damage to the amplifier under test.

2. Each INPUT terminal has its own input attenuator and buffer amplifier. Input impedance is 100 kilohm from each terminal to the Model 1700A System circuit common. The true differential input circuits of the Model 1700A System help break the ground loop that causes 60-Hz pickup on the input leads of most measuring equipment.

3. Do not connect one channel of the oscilloscope directly to the output of the amplifier under test as this can upset the noise rejection capability of the Model 1700A System differential input circuitry. If it is absolutely essential to monitor this signal, leave the ground lead of the scope channel disconnected from the amplifier under test.

1-10. OPERATING PROCEDURES

CAUTION

CONNECTING OSCILLATOR OUTPUT TO A HOT CHASSIS MAY BLOW FUSE, F2.
(Fuse located on bottom of instrument. A blown fuse will make FLOAT switch ineffective and cause hum problems.)

DO NOT EXCEED THE INPUT VOLTAGES BELOW TO PRECENT BLOWING FUSES F101 AND F102.

With Input Range Switch -- 3V and Lower
1. 300 V Below 60 Hz
2. 50 V Above 1 kHz

1-11. TEST CONNECTIONS

Before making measurements with the Model 1700A System, ensure that the equipment has been connected as shown in Figure 1-1 and following the instructions given in Paragraphs 1-6 through 1-9.

1-12. METER MECHANICAL ZERO ADJUSTMENT

The meter is correctly zero set when the pointer rests over the zero calibration marks on the scale when the Model 1700A INPUT switch is set to 300 V, the VOLTS POWER pushbutton is depressed, and there is no input signal (input leads disconnected). To adjust the zero set proceed as follows:

a. Rotate zero adjustment screw (located on front panel below meter) until pointer is left of zero. Reverse rotation until pointer is exactly at zero.

1-13. DISTORTION MEASUREMENT

To measure the total harmonic distortion of a signal, proceed as follows:

a. Set FAST RESPONSE/LOW DISTORTION switch to LOW DISTORTION and select fundamental test frequency in Hz by depressing appropriate FREQUENCY pushbuttons.

NOTE

1. Four Multiplier pushbuttons (X1, X10, X100, X1000) and 30 Digit pushbuttons permit 3-digit resolution of frequency selection. For example, 453 Hz would be selected by depressing the following pushbuttons:

Multiplier	1st. Digit	2nd. Digit	3rd. Digit	Frequency
X10	40			40x10=400
		5		5x10= 50
			.3	.3x10= 3
				453 Hz

The "100" Digit pushbutton provides a 10% overlap in range. For example, 1010 Hz can be selected in two ways:

Multiplier	1st. Digit	2nd. Digit	3rd. Digit	Frequency
X10	100			100x10=1000
		1		1x10= 10
			0	0x10= 0
				1010 Hz
X100	10			10X100=1000
		0		0x100= 0
			.1	.1x100= 10
				1010 Hz

2. In the X1 range, operation of the frequency pushbuttons may not always cause the oscillator to go through its automatic stabilization cycle. If the oscillator amplitude appears to be unstable, momentarily set the FAST RESPONSE/LOW DISTORTION switch to the FAST RESPONSE position and then return it immediately to the LOW DISTORTION setting.

b. Depress VOLTS POWER pushbutton and set ADJUST control fully CCW to CAL position.

c. Set INPUT switch to expected range setting.

d. Adjust OSCILLATOR LEVEL control and/or gain control on amplifier under test for desired voltage/power level as indicated on Model 1700A meter. Up range INPUT switch when meter pointer passes full scale and down range when meter pointer goes below 1/3 of full scale.

NOTE

If OVERLOAD indicator lights and meter reads less than full scale, meter reading is incorrect due to ADJUST control being incorrectly set. To regain accuracy, turn ADJUST control down (CCW) until OVERLOAD light is OFF.

e. Depress SET LEVEL pushbutton and rotate set level ADJUST control until meter pointer rests on SET LEVEL mark.

f. Depress DISTORTION pushbutton and rotate RATIO switch until meter pointer reaches upper 2/3's of scale. If desired, depress 400 Hz and/or 80 kHz FILTER pushbutton to filter noise from input signal.

g. Observe distortion either in percentage or dB, as indicated by meter deflection and RATIO switch setting. For example, if meter reads .67 and RATIO setting is .1%, distortion measured is .067%.

1-14. DISTORTION MEASUREMENT WITH EXTERNAL OSCILLATOR

a. Connect equipment as shown in Figure 1-1, with the following exceptions:

1. Connect power cord of external oscillator to power source close to source used by Model 1700A, amplifier under test, and oscilloscope.

2. Connect output of oscillator to input of amplifier under test. The oscillator output may be floated if this gives better test results.

3. Connect chassis of oscillator to GND ($\perp$) terminal on Model 1700A.

4. Set SIGNAL COMMON switch on Model 1700A to (ground) position.

b. Set external oscillator to desired frequency and signal level.

c. Preset Model 1700A FREQUENCY pushbuttons to approximate frequency of external oscillator.

d. Set ADJUST control fully counterclockwise (CCW) to CAL position and depress VOLTS POWER pushbutton.

e. Set INPUT switch to expected range.

f. Adjust external oscillator amplitude control and/or gain control of amplifier under test for desired voltage/power level as indicated on Model 1700A meter.

g. Depress SET LEVEL pushbutton. Rotate ADJUST control until Meter pointer rests on SET LEVEL mark.

h. Set 1700A frequency or pushbutton on external oscillator so both NOTCH FREQUENCY indicators are off and that the tuning is approximately centered.

i. Depress DISTORTION pushbutton and set RATIO switch so that meter pointer rests within upper 2/3's of scale. If desired, depress 400 Hz and/or 80 kHz pushbutton to filter noise from input signal.

j. Observe distortion in either percentage or dB, as indicated by meter deflection and RATIO range setting.

1-15. AC VOLTAGE/POWER MEASUREMENT

The Model 1700A is an accurate ac voltage/power meter over its entire frequency range. The power scale is calibrated for an 8-ohm load, which must be provided externally. Voltage may be measured directly from 3 mV to 300 V full scale and power from 1 μV to 10 kW full scale. To measure ac voltage or power, proceed as follows:

a. Ensure that the power and ground connections are as described in Paragraphs 1-7 and 1-8 respectively.

b. Connect signal to be measured between + INPUT and - INPUT terminals. Use shielded twisted-pair cable for low-level inputs. Connect shield to COM (⏚) terminal.

c. Set ADJUST control to CAL position and depress VOLTS POWER pushbutton.

d. Rotate INPUT switch for an on scale reading (pointer in upper 2/3's of scale).

NOTE

The 400 Hz and 80 kHz FILTERS do not affect readings on the ac Voltage Power measurement function.

1-16. AC VOLTAGE MEASUREMENT - EXTENDED RANGE

The sensitivity of the ac voltmeter can be extended to 30 μV full scale through the use of the RATIO switch. To obtain this increased sensitivity carry out the following steps:

a. Ensure that power and ground connections are as described in Paragraphs 1-7 and 1-8 respectively.

b. Connect signal to be measured between + INPUT and - INPUT terminals. Use shielded twisted-pair cable for signal connection. Connect shield to COM (⏚) terminal.

c. Set Model 1700A controls as follows:
dB VOLTS switch ---------- depressed
INPUT switch ---------- .3 V
ADJUST control ---------- CAL

d. Meter full scale sensitivity is now controlled by RATIO switch as follows:

RATIO switch	Full Scale Sensitivity
.01	30 mV
.03	100 mV
.1	300 mV
.3	1 mV

NOTE

The 400 Hz and 80 kHz FILTERS will affect meter readings in this mode of operation.

1-17. dB VOLTS MEASUREMENTS

The dB Volts function facilitates the measurement of voltage ratio, signal-to-noise ratio, and frequency response, in dB or percent. The signal-to-noise ratio measurement described below provides an example of the use of this function.

a. Ensure that power and ground connections are as described in Paragraphs 1-7 and 1-8 respectively.

b. Set ADJUST control to CAL position and depress VOLTS POWER pushbutton.

c. Set INPUT switch to expected range and adjust appropriate signal level controls for desired output signal, as indicated on meter.

d. Depress SET LEVEL pushbutton and rotate ADJUST control until meter pointer rests on 0 dB mark.

NOTE

For proper 0 dB or 100% set level, reference signal must be at least .1 V and not exceed 300 V.

e. Remove input signal to amplifier under test and replace with a short circuit across amplifier's input terminals. Set SIGNAL COMMON switch to ⏚ (ground) position.

NOTE

When the input signal to the amplifier under test is removed and replaced with a short, this floats entire Model 1700A measuring circuits. Proper grounding can be restored by setting the CIRCUIT COMMON switch to the ⏚ (ground) position.

f. Depress dB VOLTS pushbutton. Select RATIO switch range which places meter pointer in upper 2/3's of scale, Read test result in dB.

g. At end of signal-to-noise ratio measurement, return SIGNAL COMMON switch to FLOAT position.

1-18. AUDIO MEASUREMENTS

Operating instructions for performing certain audio measurements as specified by the Institute of High Fidelity (1960) are given below. For these tests, ensure that the following test conditions are maintained:

a. Line: 120 V ± 1%, 60 Hz, less than 2% total harmonic distortion.

b. Temperature: 25 ± 3° C.

c. Preconditioning: Unit under test should be preconditioned for 1 hour at 1/10 rated power. (FTC requires 1/3 rated power).

d. Amplifier Gain Controls: Set to maximum.

e. Amplifier Tone Controls: Flat.

f. Amplifier Balance Control: Set to normal.

g. Test Equipment: Model 1700A exceeds all IHF requirements for test equipment accuracy.

1-19. MAXIMUM POWER OUTPUT AT RATED TOTAL HARMONIC DISTORTION AT 1 kHz

NOTE

Amplifier must be able to maintain this power for 30 seconds.

a. Set Model 1700A for frequency output 1 kHz.

b. Connect SIGNAL OUTPUT to amplifier's AUX or TAPE INPUT on all channels.

c. Set RATIO SWITCH so that amplifier's rated distortion gives maximum on-scale reading, and observe distortion products on oscilloscope.

d. Increase OSCILLATOR LEVEL setting until distortion products on oscilloscope are excessive while (1) monitoring power with VOLTS POWER pushbutton depressed and (2) keeping signal on scale with INPUT switch.

e. When excessive distortion products are present, refine measurement by adjusting OSCILLATOR OUTPUT while measuring distortion until the amplifier's rated distortion is reached.

f. Switch Model 1700A to VOLTS POWER function and determine amplifier's power output at rated distortion.

1-20. POWER BANDWIDTH

a. Maintain test setup as described in Paragraph 1-19.

b. Adjust amplifier level until power is 3 dB below rated power (1/2 power) at midband (full rated power for FTC).

c. Increase Model 1700A frequency in steps from midband while measuring distortion. Stop when distortion is equal to amplifier's specifications. This is upper power bandwidth point.

d. Repeat step c, this time decreasing Model 1700A frequency until lower power bandwidth point is found. The result may be expressed briefly (for example: Power Bandwidth = 15 Hz to 37 kHz); or it may be shown as a graph of distortion versus frequency, with power held constant at 3 dB below rated power.

1-21. HUM and NOISE or SIGNAL-to-NOISE RATIO

Make this measurement following the instructions given in Paragraph 1-17 for measuring voltage ratios. Drive the amplifier to its rated power output with gain controls set to maximum. Then remove the input and obtain a dB ratio reading as described in 1-17.

SECTION II
PRINCIPLES OF OPERATION

2-1. INTRODUCTION

The Model 1700A Distortion Measurement System consists of an ultra-low distortion oscillator, a total harmonic distortion analyzer, and a dc power supply. The system makes total harmonic distortion measurements by applying a sine-wave of ultra-low distortion from the oscillator to the input of the amplifier under test while the distortion analyzer measures the amplifier output. A tunable notch filter in the analyzer, mechanically ganged to the oscillator by the front panel frequency select switches, suppresses the fundamental signal. Automatic nulling circuitry fine tunes the notch filter and ensures that the null is retained. The signal remaining at the output of the notch filter consists of the distortion products and noise. This is displayed by an average-reading voltmeter in the analyzer. The ratio of the measured distortion components to a previously set fundamental signal reference level is defined as the total harmonic distortion and can be read out directly on the meter in percent or dB. Switchable low-frequency and high-frequency filters are provided to enhance the readout of the harmonic products.

Other features of the Model 1700A include separate Voltage and Distortion measurement range switches, separate Set Level monitoring without range changing, and automatic nulling on all ranges.

The power supply provides regulated dc voltages of +15 volts and -15 volts to power the oscillator and analyzer. Both of these supplies are internally protected against accidental short circuit.

2-2. DISTORTION ANALYZER

2-3. GENERAL DESCRIPTION

Refer to Figure 4-2 for a schematic diagram of the distortion analyzer assembly. Note that the circuit is divided into the following circuit blocks: Buffer amplifier, overlaod detector, notch filter, distortion amplifier and attenuator, amplitude null filters, function switches, and ac meter. The operation of the assembly is discussed first at a circuit block level and is then followed by details of each block.

In operation, the signal to be measured is connected to the input of the buffer amplifier. This circuit has two outputs: a fixed output which may be connected to the ac voltmeter, and a variable output (controlled by the ADJUST control) which is connected to the notch filter. The voltmeter is an average reading type which measures the signal level selected by the appropriate function switch.

The overload detector monitors the variable output of the buffer amplifier. If an excessively high output voltage is detected, the detector turns on the front panel OVERLOAD indicator.

The notch filter is mechanically ganged to the oscillator frequency select switches and suppresses the fundamental from the output of the buffer amplifier. The output of the notch filter is connected to the input of the distortion amplifier through a step attenuator controlled by the front panel RATIO switch. The attenuator adjusts signal level for the distortion amplifier for various percentages of distortion or ratio readings.

The amplitude null control and phase null control circuits supply the notch filter with its automatic nulling feature. Both circuits monitor the output of the distortion amplifier and feed control signals back to the notch filter.

The sum-point buffer supplies reference signals to the tuning indicator and to the amplitude null control circuit.

The tuning indicator circuit, using frequency information from the notch filter, provides the operator with a visual indication of the frequency being analyzed versus the input frequency. This circuit operates the NOTCH FILTER HIGH and LOW indicators.

The switchable low-frequency and high-frequency filters are connected to the output of the distortion amplifier. This permits them to be selected for DISTORTION and dB VOLTS measurements only.

The function switches select the circuit to be measured by the ac voltmeter. When the VOLTS POWER switch is depressed, the meter monitors the output via a stepped attenuator from the buffer amplifier. When the SET LEVEL switch is depressed, the meter monitors the variable output of the buffer amplifier. Operation of the DISTORTION switch routes the signal from the distortion amplifier via the low-frequency and high-frequency filters (if selected) to the meter. When the dB VOLTS switch is depressed, it connects the variable output from the buffer amplifier directly to the attenuator at the input of the distortion amplifier and hence to the meter.

2-4. BUFFER AMPLIFIER

The input of the buffer amplifier contains a pair of step attenuators, one for each INPUT connector. The attenuators are controlled by Sections S1A, B, C, D of the INPUT switch. The attenuator outputs are connected to input signal preamplifiers U101 and U102. The gain of these units is controlled by section S1E of the INPUT switch. Gain is unity on the 3 V range and above, 3.16 on the 1 V range, and 10 on the .3 V range and below. The preamplifier outputs are coupled to U103, a bridge amplifier circuit which effectively acts as a differential to single-ended converter with high common-mode noise rejection. The gain of the bridge amplifier is controlled by ADJUST potentiometer R125 and provides the variable signal supplied by the buffer. The range of gain is 10 dB and full scale voltage is 3.16 volts. The fixed output from the buffer is obtained between the wiper of R125 and ground. This signal remains fixed regardless of the setting of R125, except when the buffer overloads.

2-5. OVERLOAD DETECTOR

The overload detector signals an overload condition when the variable output of the buffer amplifier exceeds approximately 6.5 volts rms sine wave or 9 volts peak. The circuit consists of comparator U107, a half-wave rectifier and filter, a light-emitting diode driver, and OVERLOAD indicator CR120.

2-6. NOTCH FILTER

The notch filter consists of two 90-degree phase shifters connected in series, making the output 180 degrees out of phase with the input. By summing the input and output at summing amplifier U203, the fundamental of the input signal is cancelled out. Feedback from the output of the summing amplifier to the input of the filter increases the Q of the circuit and narrows the rejection band of the filter.

Tuning is controlled by changing a set of RC elements for each phase shifter through operation of the front panel Multiplier and Digit pushbutton switches. When the reactance of the capacitance equals the resistance at the incoming frequency, the phase shift is 90 degrees. The RC components are contained in the frequency module (see Figure 4-5 for schematic diagram).

2-7. DISTORTION AMPLIFIER AND ATTENUATOR

The output of the notch filter is coupled through a 7-step attenuator to the input of distortion amplifier U204. The attenuator is controlled by section S2D of the front panel RATIO switch and reduces the distortion product of the notch filter such that the full scale voltage input to the amplifier is 1 mV on ranges .03% through 100% and .316 mV on all ranges.

2-8. AMPLITUDE NULL CONTROL

The amplitude null control circuit controls the amplitude of the signal from the cascaded phase shifter so that exact balance occurs when it is summed with the input to the phase shifters. This ensures the total cancellation of the fundamental signal. The components which perform this function include phase detector U310, floating integrator and voltage follower U312, integrating amplifier U311, integrating capacitors, and a photocoupler controlling a variable resistor element in the summing network.

The reference input to phase detector U310 is a signal which is in phase with the fundamental and the signal input to U310 is the distortion product output by the distortion amplifier. With these inputs, the phase detector monitors the notch filter output for an in-phase signal. When this occurs the output of the phase detector supplies drive to the integrator causing the charge on the integrating capacitors to change. This in turn causes the photocoupler to change the value of the variable resistor which in effect adjusts the summing current until the in-phase component is no longer there.

The integrating capacitors are changed by the RATIO attenuator switch. This in effect maintains the automatic null control loop gain at a relatively constant level, resulting in high-speed nulling on all ranges. The capacitors are precharged to the integrator output voltage level through resistor R360. This avoids switching transients and improves the speed of the circuit.

2-9. PHASE NULL CONTROL

The phase null control circuit fine tunes the phase of the second phase shifter in the notch filter so that the overall phase shift is exactly 180 degrees. This ensures total cancellation of the fundamental signal. The components which perform this function include phase detector U307, floating integrator and voltage follower U309, integrating capacitors, and a photocoupler controlling a variable resistor in the resistive branch of the second phase shifter.

The reference input to phase detector U307 is the distortion product output by the distortion amplifier. With these inputs the phase detector monitors the notch filter output for an out-of-phase signal. When this occurs, the phase detector output supplies drive to the integrator causing the charge on the integrating capacitors to change. The integrator output drives the variable gain amplifier, U313, and the voltage to current converter, U314, which in turn causes the photocoupler to change the value of the variable resistor which in effect adjusts the phase angle until the out-of-phase component is no longer there.

The integrating capacitors are changed by the RATIO attenuator switch. This in effect maintains the automatic null control loop gain at a relatively constant level, resulting in high-speed nulling on all ranges. The capacitors are precharged to the integrator output voltage level through resistor R344. This avoids switching transients and improves the speed of the circuit.

A set of resistors that feed signal from integrator, U308, to U313 which act as gain control is switched by the front panel FREQUENCY switches. This maintains a relatively constant integrator voltage when frequency is changed and helps to achieve perfect nulling in less than 5 seconds.

2-10. SUM-POINT BUFFER

The sum-point buffer supplies a signal from the notch filter summing point to the tuning indicator and the amplitude null control, each of which uses the signal as the reference input to a phase detector. The buffer consists of unity-gain amplifier U301 and high-gain high-speed amplifier U302. These components convert the sine wave at the summing point into a square wave signal.

2-11. TUNING INDICATOR

The tuning indicator monitors the phase relationship between the signal input to the notch filter's first phase shifter and its output. The relationship is frequency dependent and is 90 degrees when the incoming frequency is exactly the same as the tuned frequency of the notch filter. The components performing this function include phase detector U303, high-speed amplifier/drivers U304, U305 and HIGH and LOW indicators CR301, CR302.

The reference input to phase detector U303 is the signal at the input to the phase shifter (connected via the sum-point buffer) and the signal input to U303 is the output of the phase shifter. When the incoming frequency is exactly the same as the tuned frequency of the notch filter (90-degree phase relationship), there is no output from the phase detector. Under these conditions both indicators are off. However, if the frequency of the notch filter is high compared with the input frequency, U303 produces a dc output which turns on the HIGH indicator. Conversely, if the frequency of the notch filter is low compared with the input frequency, a dc output of the opposite polarity from U303 turns on the LOW indicator.

2-12. FILTERS

Each filter is an active 3-pole Butterworth having a flat response within its pass-band and an attenuation slope of -18 dB/octave. The -3 dB point is 80 kHz for the low-pass filter and 400 Hz for the high-pass filter.

2-13. FUNCTION SWITCHES

The function switches select the circuit to be measured by the ac voltmeter. When the VOLTS POWER switch is depressed the meter monitors the fixed output, via a step attenuator, from the buffer amplifier. When the SET LEVEL switch is depressed, the meter monitors the signal from a divider connected to the variable output of the buffer amplifier. Operation of the DISTORTION switch routes the signal from the distortion amplifier via the low-frequency and high-frequency filters (if selected) to the meter. This connection is not made directly by the DISTORTION switch but by the release of the SET LEVEL and VOLTS POWER switches which occurs automatically when the DISTORTION switch is depressed. When the dB VOLTS switch is depressed, it connects the variable output from the buffer amplifier directly to the attenuator at the input of the distortion amplifier and hence to the meter.

2-14. AC METER

The ac meter circuit consists of high-gain wide-band amplifier U104, a full-wave bridge rectifier circuit, and dc milliammeter M1. It indicates the average value of an ac signal. The input sensitivity is 31.6 mV full scale. The gain of the meter is adjusted by potentiometer R157.

2-15. OSCILLATOR

2-16. GENERAL DESCRIPTION

Refer to Figure 4-4 for a schematic diagram of the oscillator assembly. The oscillator is basically a Wein bridge type with a unique ultra-low distortion amplitude control circuit. This control circuit provides (1) wide frequency range (2) fast settling (3) flat frequency response and (4) ultra-low distortion. No one of these characteristics is sacrificed in order to achieve an improvement in the others.

The oscillator has two operating modes - Fast Response and Low Distortion. When Fast Response is selected the oscillator amplitude settles quickly after a frequency change; when Low Distortion is chosen, the oscillator settling time to .002% distortion is less than 5 seconds. Built-in control circuitry automatically guides the oscillator through these modes whenever there's disturbance to the amplitude, for example, a change of frequency setting.

2-17. OSCILLATOR CIRCUIT

The basic Wein bridge oscillator consists of a reactive positive feedback network and a resistive negative feedback network, both of which are tied to the output of oscillator amplifier U1. The positive feedback network feeds back to the positive terminal of the amplifier and the negative feedback network is coupled to the negative terminal of the amplifier. Frequency of oscillation is determined in the positive feedback network by the relationship:

$$f = \frac{1}{2 \pi RC}$$

Where front panel Multiplier switches change a set of capacitors for each frequency range and the Digit switches change the resistance value. These components are located in the frequency module (see Figure 4-5 for schematic diagram).

2-18. AMPLITUDE CONTROL

The ultra-low distortion amplitude control circuit consists of two control loops: A high-speed loop and a low-speed loop. These two loops, acting together, effectively vary the negative feedback ratio to regulate the oscillator amplitude.

The high-speed loop, composed of the following major components, stabilizes the oscillator from cycle to cycle.

a. Peak Detector Q2, Q3.

b. Active RC filter U2 and associated RC element.

c. Voltage-controlled resistor (VCR) Q1.

The high-speed loop, consisting of the following major components, monitors the bias applied to the VCR and ensures that the bias is always at an optimum value for low distortion.

a. Comparator R17, R18 (these components are also input resistors for integrator U3).

b. Integrator U3 and associated integrating capacitor.

c. Photocoupler U7.

In the following circuit description, assume that the oscillator has been set for Fast Response operation. In this mode relays K1 and K2 are de-energized, resulting in the following circuit conditions:

a. The time constant for active RC filter U2 is relatively short.

b. The time constant for integrator U3 is relatively short.

c. A high value of resistance is connected in parallel with the VCR section of the negative feedback loop. This allows the VCR to have a wide control range.

In operation, when power is first applied to the unit, there is no input from the oscillator. This causes the output of RC filter U2 to be zero and VCR Q1 to be at its lowest resistance. At the same time, the output of integrator U3 is also zero, which cuts off the drive to the light source in U7. This causes the photoresistor to have a very high resistance. These conditions result in a very low negative feedback ratio in the oscillator, causing it to start immediately after power is applied.

When the oscillator amplitude passes a reference voltage (voltage V2 across R15) at peak detector Q2, Q3, the detector produces an output current which starts to charge up RC filter U2. This in turn creates a large bias voltage (V1) to the VCR which increases its resistance. This tends to lower the amplitude of the oscillator. At the same time, comparator R17, R18 detects that voltage V1 is increasing and when it becomes greater than its reference voltage (V3), the comparator produces a current which drives integrator U3 to turn on the light source in U7. The photoresistor responds by decreasing its resistance, tending to further dampen the amplitude of the oscillator. This action continues until (1) The oscillator amplitude equals the reference voltage (V2) and (2) the VCR bias voltage (V1) equals the reference voltage (V3).

After the oscillator has reached a steady state condition, the circuit continues to operate as follows: Any time the oscillator amplitude is lower than the reference voltage (V2), the ac peak detector Q2, Q3 reduces drive to the RC filter and VCR. This in turn causes the VCR to decrease its resistance, bringing the oscillator amplitude back to the reference level (V2). If the oscillator amplitude is higher than the reference, a reverse action increases the VCR resistance. This operation occurs once per cycle and is performed by the high-speed loop.

The bias (V1) on the VCR is constantly monitored by comparator R17, R18 against reference voltage V3. Any difference in voltage level results in a current of corresponding polarity. This current is integrated constantly by integrator U3. Over a given period of time, if there is an average net increase of VCR bias, there will be an increase of drive to the light source of U7. (The opposite is true for a net decrease of VCR bias). This increase in drive to the light source will result in a decrease of resistance in photoresistor U7. When this occurs, the VCR is no longer required to have such a high resistance and hence high bias voltage V1. Therefore, the bias voltage (V1) for the VCR will gradually return to its predetermined value, the reference voltage V3. This action, which provides a constant optimum bias for the VCR, is performed by the low-speed loop.

Now assume that the oscillator has been set for Low Distortion operation and it is in a steady state condition. At this time, relays K1 and K2 are energized resulting in the following circuit conditions:

a. The time constant for active RC filter U2 is now longer. This filters the sawtooth voltage driving VCR Q1 to almost a dc level, minimizing its distortion effect.

b. The time constant for integrator U3 is now longer. This ensures that the stability of the control system is maintained.

c. Resistor R8 is shunted in parallel with VCR Q1. This greatly limits the control range of the VCR, reducing its distortion effort.

The oscillator remains in this state until a disturbance to the oscillator amplitude occurs. At this time, the high-speed loop, in an attempt to maintain the oscillator amplitude, creates an abnormal bias level for VCR Q1. This level is sensed by level detector Q4, Q5 which in turn triggers one-shots U6A, U6B with the result that relays K1 and K2 are de-energized. This places the amplitude control system in the Fast Response mode previously discussed. The system remains in this state for 2½ seconds.

At the end of the 2½ second interval, relay K1 is energized. This causes the following circuit action:

a. A shunt is placed across VCR Q1 to limit its control range.

b. The time constant of integrator U3 is increased to maintain circuit stability.

c. A large capacitor is allowed to charge to the steady state output value of active RC filter U2.

d. A large capacitor is allowed to charge to the steady state output value of integrator U3.

During this intermediate state, which also lasts 2½ seconds, the oscillator settles to a steady state condition. At the end of this interval, relay K2 is energized. This causes the following circuit action:

a. The precharged capacitor is connected across RC filter U2.

b. The precharged capacitor is connected across the integrator U3.

Thus, after 5 seconds, the control system is back in the ultra-low distortion mode with relays K1 and K2 energized.

2-19. POWER SUPPLY

2-20. GENERAL DESCRIPTION

Refer to Figure 4-7 for a schematic diagram of the power supply. The assembly consists of a regulated +15 Vdc supply and a regulated -15 Vdc supply, both of which feature current foldback and current limiting.

2-21. INPUT CURCUIT

Main power is coupled to the primary of transformer T1 via POWER switch S3, 115/230 Vac select switch S5, and fuse F1. Transformer T1 steps the main voltage down to the appropriate level for the individual power supply circuits.

2-22. +15 Vdc SUPPLY

Full wave rectifier CR601-604 and filter capacitor C601, connected to a secondary winding on T1, produce an unregulated output of approximately +28 Vdc. The regulation circuit includes pass element Q601, and integrated circuit regulator U601. Potentiometer R603 allows the output to be set to exactly +15 Vdc.

2-23. -15 Vdc SUPPLY

The -15 Vdc supply is similar to the +15 Vdc supply described above except that the outputs are reversed, resulting in a negative potential with respect to power supply ground. Also, the output of this supply is not adjustable.

SECTION III
MAINTENANCE

3-1. INTRODUCTION

This section provides performance checks, adjustment and calibration procedures, troubleshooting techniques, and repair instructions for the Model 1700A.

3-2. TEST EQUIPMENT

Recommended test equipment for performance checking and troubleshooting is listed in Table 3-1. Test instruments other than those described can be used provided their specfications equal or exceed those listed.

3-3. PERFORMANCE CHECK

CAUTION

Due to the ultra-low distortion characteristics of the Model 1700A, only test equipment with the specifications described in Table 3-1 is capable of making the distortion measurements called for in this check. Use of test equipment with equal or higher residual distortion to measure, for example, the low distortion oscillator, will result in erroneous readings due to:

a. Residual distortion of measuring equipment.

b. Reinforcement or cancellation effect of distortion products.

3-4. GENERAL INFORMATION

This check can be used as an incoming inspection check and the Overall System Check portion (Paragraph 3-5) can be used as a quick method of verifying correct system operation. If the correct results are not obtained, refer to the information contained in Troubleshooting (Paragraph 3-29).

Before beginning the check, ensure that all external equipment (oscilloscope, amplifier under test, etc.) is completely disconnected from the Model 1700A.

3-5. OVERALL SYSTEM CHECK

3-6. Distortion Test

NOTE

1. Before beginning the test, ensure that all external equipment is completely disconnected from the Model 1700A.

2. This test measures the overall distortion of the system, with distortion from both the oscillator and the distortion analyzer contributing to the result. To measure the distortion of the analyzer assembly, an extremely pure source with a distortion of .0002% is required.

a. Connect cable between SIGNAL OUTPUT BNC connector and INPUT terminals. Use - (minus) terminal for BNC shell.

b. Set Model 1700A controls as follows:

SIGNAL COMMON switch	⏚
INPUT switch	3 V
ADJUST control	CAL
OSCILLATOR LEVEL control	fully ~~ccw~~ cw
FAST RESPONSE/LOW DISTORTION switch	LOW DISTORTION
FREQUENCY pushbutton	X10 100 = 1000 Hz
FILTERS pushbuttons	80 kHz

Table 3-1 Required Test Equipment

TYPE	REQUIRED CHARACTERISTICS	USE	RECOMMENDED MODEL
AC Calibrator	Voltages: 316.2 mV, 1.000 mV, 3.162 V rms Accuracy: ± .1% at 1 kHz	Adjustment and Calibration	Fluke Model 5200A (*See alternate method described below).
Digital Multi-Meter	DC Voltage Range: 200 mV to 200 V ± .1% AC Voltage Range: 200 mV to 200 V ± .5% Resistance Range: 200 ohms to 20 M ohms ± .2%	Adjustment and Calibration Troubleshooting	Fluke Model 8000A
Frequency Counter	Frequency Range: 10 Hz to 110 kHz Period Measurements: 10 Hz to 1 kHz Accuracy: ± .1%	Adjustment and Calibration Troubleshooting	Fluke Model 1900A
Oscilloscope	Bandwidth: DC to 10 mHz Vertical: Dual Channel	Adjustment and Calibration Troubleshooting	Hewlett-Packard Model 1220A or Philips Model PM3232
Oscillator and THD Analyzer	Frequency Range: 10 Hz to 110 kHz Residual Distortion: .002%, 10 Hz to 10 kHz	Troubleshooting	Sound Technology Model 1700A

*To produce fairly accurate AC voltages: For 3.00 Vrms -- Monitor oscillator output with Digital Multimeter.

For 1.000 Vrms -- Set 1700A under test to 100 V range and set oscillator output for a 31.6 mV rms output with Digital Multimeter.

For .3162 mVrms -- Same as above except set 1700A under test to 300 V range.

c. Depress SET LEVEL pushbutton and rotate ADJUST control until meter pointer is over SET LEVEL mark.

d. Depress DISTORTION pushbutton and set RATIO switch to .01 range. Check that distortion reading is less than .004%.

e. Select following oscillator frequencies and check that distortion reading for each is less than percentage given.

Multiplier	Digit	Frequency	Distortion
X10	10	100 Hz	.004
X1	10	10 Hz	.0045
X1	100	100 Hz	.004
X100	100	10 kHz	.004
X100	10	1 kHz	.004
X1000	10	10 kHz	.004

f. Set RATIO switch to .03 range and change oscillator frequency to 100 kHz (X1000 and 100 pushbuttons).

g. Release 80 kHz FILTER pushbutton. Check that distortion reading is less than .2%.

3-7. Circuit Common Isolation Check

a. Disconnect all cables for Model 1700A and set POWER switch to OFF.

b. Measure resistance between GND (⏚) and COM (▽) terminals for each setting of SIGNAL COMMON switch. Check that readings are within tolerance given below:

SIGNAL COMMON switch	Resistance
FLOAT	>10 megohm
⏚	<0.5 ohm

c. Set SIGNAL COMMON switch to ⏚ position and reconnect cable between SIGNAL OUTPUT and INPUT terminals. Set POWER switch to ON.

3-8. OSCILLATOR CHECK

3-9. Frequency Test

a. Set Model 1700A controls as follows:

OSCILLATOR LEVEL control---------- fully CW
FAST RESPONSE/LOW DISTORTION switch---------- FAST RESPONSE
FREQUENCY pushbuttons---------- X10, 100 = 1 kHz

b. Connect SIGNAL OUTPUT BNC connector to frequency counter and wide-band ac voltmeter. Measure amplitude of oscillator output. Check that it exceeds 3 volts.

c. Select following oscillator frequencies and check that (1) frequency is ± 2% of set value and (2) frequency response is flat within 0.2 dB.

NOTE

The Model 1700A can be used to measure the ac voltage. If this is done, the drop in response at 10 Hz is caused by the characteristics of the voltmeter and not the oscillator.

Multiplier	Digit*	Frequency
X10	10	100 Hz
X1	10	10 Hz
X1	100	100 Hz
X100	100	10 kHz
X100	10	1 kHz
X1000	10	10 kHz

*Set remaining digits to 0.

3-10. Distortion Test

a. Set FAST RESPONSE/LOW DISTORTION Switch to LOW DISTORTION and set ADJUST control to CAL.

b. Measure distortion of oscillator at frequencies listed in Paragraph 3-9.

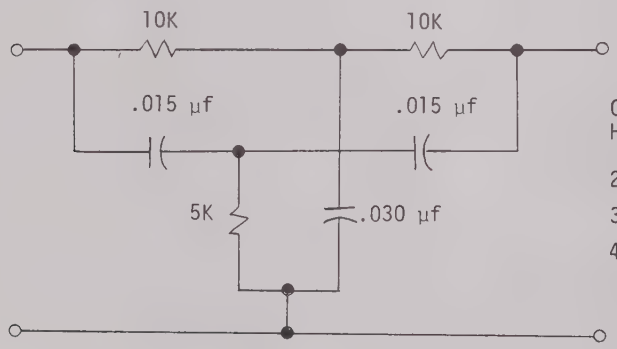
NOTE

The measurement technique for making oscillator distortion measurements (and the accuracy of the reading) depends on the type of test equipment available to the user. In general, this equipment will fall into the following three categories, listed below in order of measurement accuracy:

1. Model 1700A. In the absence of a wave analyzer, the Model 1700A can be used to make a rough check of the oscillator's distortion. Carry out the Distortion Test described in Paragraph 3-6.

2. Wave analyzer with a residual distortion of less than -60 dB. Set the Model 1700A to the 3V range and adjust the OSCILLATOR LEVEL control for a set level mark of -10 dB. Then use the wave analyzer to sort out the harmonic distortion products of the oscillator. This measurement is, in general, accurate to approximately .0005%.

3. Wave analyzer with a residual distortion of less than -80 dB. Set the oscillator output as described in 2 above. Connect a twin-T filter, which must attenuate the fundamental by at least 40 dB, ahead of the wave analyzer. Then use the wave analyzer to sort out the harmonic distortion products. This method is, in general, accurate to .0001% or 1 ppm. A suitable twin-T network for 1.06 kHz is shown in Figure 3-2.



Correction Factors For Harmonics:

2nd.	2.8
3rd.	1.8
4th	1.5

NOTE: All resistors are metal-film type, ± 1% tolerance
All capacitors are polystyrene type, ± 1% tolerance

FIG. 3-2

3-11. DISTORTION ANALYZER CHECK

3-12. dB Volts Test

a. Set Model 1700A controls as follows:

INPUT switch---------- 30 V
OSCILLATOR LEVEL control---------- fully CCW
FAST RESPONSE/LOW DISTORTION switch---------- LOW DISTORTION
LOW DISTORTION switch---------- X10 / 100 = 1000 Hz
RATIO switch---------- .01
SIGNAL COMMON switch---------- ⏚

b. Depress dB VOLTS pushbutton and adjust OSCILLATOR LEVEL control for full scale reading on meter.

c. Set RATIO switch to next higher range and check that signal drops by approximately 10 dB.

d. Again adjust OSCILLATOR LEVEL control for a full scale reading and then set RATIO switch to next higher range. Check that signal again drops by approximately 10 dB.

e. Repeat this operation until a -10 dB reading on 10% range is reached. At this time, set OSCILLATOR LEVEL control fully clockwise and then rotate ADJUST control for a full scale reading.

f. Set RATIO switch to 30% range and check that signal drops approximately 10 dB.

Rotate ADJUST control for full-scale reading. Set RATIO switch to 100% range. Check that signal drops approximately 10 dB.

3-13. Volts Power Test

a. Set Model 1700A controls as follows:

INPUT switch---------- .003 V
ADJUST control---------- CAL
OSCILLATOR LEVEL control---------- fully CCW
FAST RESPONSE/LOW DISTORTION switch---------- FAST RESPONSE
FREQUENCY pushbuttons---------- X10, 100 = 1000 Hz
SIGNAL COMMON switch---------- ⏚

b. Depress VOLTS POWER pushbutton and adjust OSCILLATOR LEVEL control until meter pointer indicates full scale.

c. Set INPUT switch to next higher range and check that signal drops by approximately 10 dB.

d. Again adjust OSCILLATOR LEVEL control for a full scale reading and then set INPUT switch to next higher range. Check that signal again drops by approximately 10 dB.

e. Repeat this operation until 3 volt range is reached. At this time turn OSCILLATOR LEVEL control fully clockwise. Now up range INPUT switch through the remainder of its ranges, checking that signal drops by approximately 10 dB on each range.

3-14. Filters Test

a. Set Model 1700A controls as follows:

INPUT switch---------- 3 V
ADJUST control---------- CAL
OSCILLATOR LEVEL control---------- fully CW
FAST RESPONSE/LOW DISTORTION switch---------- LOW DISTORTION
FREQUENCY pushbuttons---------- X10, 40 = 400 Hz
RATIO switch----------0 dB
SIGNAL COMMON switch---------- ⏚

b. Depress dB VOLTS pushbutton and adjust OSCILLATOR LEVEL control for a 0 dB meter reading.

c. Depress 400 Hz FILTERS pushbutton. Check meter for a -3 dB reading.

d. Release 400 Hz FILTERS pushbutton.

e. Set oscillator frequency to 80 kHz (depress X1000 and 80 pushbuttons) and depress 80 kHz FILTERS pushbutton. Check that signal attenuation is -3 dB or more.

3-15. Residual Noise Test

a. Set Model 1700A controls as follows:

INPUT switch---------- 3 V
ADJUST control---------- CAL
OSCILLATOR LEVEL control---------- fully CW
FAST RESPONSE/LOW DISTORTION switch---------- LOW DISTORTION
FREQUENCY pushbuttons---------- X10, 100 = 1000 Hz
FILTERS pushbuttons---------- 80 kHz
SIGNAL COMMON switch---------- ⏚

b. Depress SET LEVEL pushbutton and adjust OSCILLATOR LEVEL control until meter pointer is at SET LEVEL mark.

c. Depress DISTORTION pushbutton and set RATIO switch to .01 range. (This reading is noise and distortion of oscillator and analyzer).

d. Depress SET LEVEL pushbutton and adjust OSCILLATOR LEVEL control for a meter reading of -15 dB. (This greatly reduces the level of the signal input to the analyzer with the result that almost all of the distortion products are eliminated and only the residual noise of the analyzer remains).

e. Depress DISTORTION pushbutton. Check that meter reading is less than .0025%.

f. Remove cable connected between SIGNAL OUTPUT connector and INPUT terminals.

g. Place a shorting link between INPUT terminals and connect to COM (⏚) terminal.

h. Depress dB VOLTS pushbutton and set controls as follows (meter full-scale sensitivity is now 30 μV).

INPUT switch---------- .3 V
ADJUST control---------- CAL (fully CCW)
RATIO---------- .01%

i. Depress 80 kHz FILTERS pushbutton and check that meter reading is less than 8 μV.

j. Release 80 kHz pushbutton and check that reading is less than 15 μV.

3-16. Common Mode Rejection Test

a. Connect SIGNAL OUTPUT BNC connector to INPUT terminals and set oscillator frequency to 60 Hz (depress X1 and 60 pushbuttons).

b. Depress VOLTS POWER pushbutton and adjust OSCILLATOR LEVEL control for a meter reading of 1 volt.

c. Remove cable from INPUT terminals and short + and - INPUT terminals together. Now connect input cable between - INPUT and GND (⏚) terminals.

d. Set RATIO switch to -20 dB range and ADJUST control to CAL position.

e. Depress dB VOLTS pushbutton. Check that meter reading is -20 dB or lower.

3-17. ADJUSTMENT and CALIBRATION PROCEDURE

The following is a complete adjustment and calibration procedure for the Model 1700A. The procedure should be carried out only when the Performance check (Paragraph 3-3) indicates that adjustments are required. If the Model 1700A does not meet the test limits specified in the following steps, consult the troubleshooting information provided in Paragraph 3-29. The location of the adjustment controls in the analyzer, oscillator, and power supply are shown in Figures 4-1, 4-3, and 4-6 respectively.

3-18. OSCILLATOR SECTION

3-19. +15 Volt Adjustment

a. Connect HI lead of digital voltmeter (DVM) to +15 volt terminal and LO lead to GND terminal on power supply assembly.

b. Adjust potentiometer R603 for DVM reading of +15.000, ± .010 V.

3-20. Photocell AC Voltage Adjustment

a. Set Model 1700A controls as follows:

FREQUENCY pushbutton----------X10 / 10 = 100 Hz
FAST RESPONSE/LOW DISTORTION switch---------- FAST RESPONSE

b. Connect HI lead of DVM to junction of R3 and R4; connect DVM LO lead to "O" terminal (oscillator output) on oscillator board.

c. Adjust R5 for AC voltage reading of .20V.

NOTE

Clockwise rotation of R5 decreases voltage, counterclockwise rotation increases voltage.

3-21. Oscillator Integrator Voltage Change Adjustment

a. Set Model 1700A controls as follows:

FREQUENCY pushbutton---------- X10 / 10 = 100 Hz
FAST RESPONSE/LOW DISTORTION switch---------- FAST RESPONSE

b. Connect DVM HI lead to TP6 and LO lead to GND.

c. Connect TP3 to GND with clip lead. Note dc voltage reading on DVM.

d. Remove clip lead from TP3. Adjust potentiometer R7 for same dc voltage noted in Step c. ± .005 V.

NOTE

The following is an alternative method of measuring the TP6 voltage with a floating VTVM:

Connect LO terminal of VTVM to positive terminal of C603 on power supply board and the HI terminal to TP6. (In this case, the dc potential at C603 is used as a bucking voltage so that the VTVM can be set to a lower (move sensitive) range to resolve the required 5 mV).

3-22. Oscillator Integrator Output Adjustment

CAUTION

If the photocoupler has been replaced, allow at least 10 minutes to elapse before proceeding with this adjustment. This is to allow the unit (and the technician!) to cool off after soldering.

a. Set Model 1700A controls as follows:

FREQUENCY pushbuttons---------- X10 10 = 100 Hz
FAST RESPONSE/LOW DISTORTION switch---------- FAST RESPONSE

b. Connect DVM HI lead to TP6 and LO lead to GND. Adjust R20 for +6.5* volts dc at TP6.

*The 6.5 V setting is for a dark adapted photocoupler. This is a photocoupler which has been in the off state for the last 24 hours (instrument power off). It is normal for the voltage at TP6 to gradually increase with time.

If the dc voltage at TP6 is greater than +8 V after the instrument has been on for 24 hours or more, readjust R20 for +8 V at TP6.

3-23. Oscillator X1000 Frequency Range Adjustment

a. Depress Model 1700A X1000 Multiplier and 1st Digit 10 FREQUENCY pushbuttons. Set 2nd and 3rd Digits to zero.

b. Monitor (1) dc voltage between TP6 and GND and (2) frequency of oscillator.

c. Adjust trimmer capacitors across C33 and C38 with an insulated trimmer tool until (1) dc voltage is in range of 6.5 V to 8 volts and (2) frequency is 10.0 kHz ± 1.5%.

d. Depress 100 Digit FREQUENCY pushbutton. Check that (1) dc voltage is in range of 6.5 to 8 volts and (2) frequency is 100 kHz ± 1.5%.

e. Repeat Steps c. and d. until voltage and frequency readings are within specifications stated.

3-24. ANALYZER SECTION

3-25. Dc Zero Adjustment

a. Connect a short between +INPUT, -INPUT and COM (⏚) terminals.

b. Set Model 1700A controls as follows:

INPUT switch---------- .3 V
ADJUST control---------- fully CW

c. Connect DVM HI lead to TP1 and LO lead to TP2. Adjust potentiometer R219 for a DVM reading of zero volts ± 10 mV.

d. Connect DVM HI lead to negative side of capacitor C209. Adjust potentiometer R217 for DVM reading of zero volts ± 10 mV.

e. Connect DVM HI lead to TP9 (located at rear of board).

f. Set Model 1700A controls as follows:

INPUT switch---------- 3 V
ADJUST control---------- CAL (fully CCW)
RATIO switch---------- .01

g. Adjust potentiometer R234 for reading of zero volts ± 10 mV.

3-26. Null Adjustment

a. Set Model 1700A controls as follows:

INPUT switch---------- 3 V
ADJUST control---------- CAL (fully CCW)
RATIO switch---------- 10%
DISTORTION pushbutton---------- depressed

SIGNAL COMMON switch---------- ⏚ (ground)
FREQUENCY pushbuttons---------- X10 / 10 = 100 Hz
OSCILLATOR LEVEL control---------- fully CW
LOW DISTORTION/FAST RESPONSE switch---------- LOW DISTORTION
FILTERS---------- 80 kHz depressed

b. Connect cable between SIGNAL OUTPUT connector and INPUT terminals.

c. Connect one channel of oscilloscope to BUFFERED INPUT SIGNAL connector (at rear of instrument).

d. Adjust oscilloscope so that waveform is synched to Buffered Input Signal.

e. Monitor waveform at pin 6 of U312 with the other channel.

f. Adjust R351 for minimum fundamental signal at pin 6 of U312.

g. Now, monitor waveform at DISTORTION OUTPUT.

h. Adjust potentiometers R337 and R354 until Distortion output waveform contains no fundamental signal.

3-26A. Phase Null Integrator Voltage Adjustment

a. Set Model 1700A controls as described in Paragraph 3-6, Steps a. through d.

b. Connect DVM HI lead to TP9 and LO lead to TP6.

c. Adjust R364 for a dc voltage reading of 2.8V*.

*The 2.8V setting is for a dark adapted photocoupler. This is a photocoupler which has been in the off state for the last 24 hours (instrument power off). It is normal for the voltage at TP6 to gradually increase with time.

If the dc voltage between TP9 and TP6 is greater than 3.0 V after the instrument has been on for 24 hours or more, readjust R364 for 3.0 V.

3-27. Tuning Indicator Adjustment

a. Set Model 1700A controls as follows:

INPUT switch	3 V
ADJUST control	CAL (fully CCW)
RATIO switch	1%
FREQUENCY pushbuttons	X10 (2nd. and 3rd. digits to zero)
OSCILLATOR LEVEL control	fully CW
FAST RESPONSE/LOW DISTORTION	FAST RESPONSE
SIGNAL COMMON switch	⏚ (ground)

b. Connect DVM LO lead to green wire connected to NOTCH FREQUENCY indicators and HI lead to junction of R320 and pin 6 of U305.

c. Depress in turn each FREQUENCY 1st digit pushbutton and observe DVM voltage readings. Record (1) digit giving most positive reading and its value and (2) digit giving most negative reading and its value.

d. Depress X1 Multiplier FREQUENCY pushbutton, and repeat procedure described in Step c.

e. Depress X100 Multiplier FREQUENCY pushbutton and repeat procedure described in Step c.

f. Review all readings recorded and determine (1) most positive value and (2) most negative value. Add these two values together (to determine voltage range) and then divide number by 2 (to determine mid-point).

g. Depress digit previously determined to have most positive reading and adjust potentiometer R312 until DVM indicates mid-point value determined in Step f. See example below:

Multiplier	Most Pos. Digit	Most Neg. Digit
X10	60, + 1.0 V	50, + .20 V
X1	60, - .20 V	50, - .70 V
X100	60, + .01 V	50, - .60 V

Overall most positive = X10, 60 = + 1.0 V
Overall most negative = X1, 50 = - .70 V
Range = 1.70 V, mid-point = .85 V
Adjust X10, 60 for + .85 V

h. Depress X1000 Multiplier pushbutton and repeat Steps c. and f.

i. Now depress digit giving most positive value and using a non-metallic screwdriver, adjust trimmer capacitor accessible through hole in shield on right-hand side of instrument for mid-point value determined in repeat of step f.

3-28. Calibration at 1 kHz

a. Set Model 1700A controls as follows:

VOLTS POWER pushbutton	depressed
FILTERS	out
FREQUENCY pushbutton	X10 / 100 = 1 kHz
INPUT switch	3 V
ADJUST control	CAL (fully CCW)
RATIO switch	.03%
SIGNAL COMMON switch	⏚ (ground)

b. Set meter mechancial zeroing as described in Paragraph 1-12.

c. Apply an accurate 3.162 V ± 0.1% or better 1 kHz signal between +INPUT and -INPUT terminals. Connect low side of test signal to -INPUT.

d. Connect chassis of precision ac source of GND (⏚) terminal on Model 1700A.

e. Adjust Meter Sensitivity potentiometer R157 for an exact full-scale reading (1.0 mark on VOLTS scale) on meter.

f. Depress SET LEVEL pushbutton. Adjust Set Level potentiometer R146 for an exact full-scale reading.

g. Change input signal level to 1.000 mV. Depress dB VOLTS pushbutton and adjust Distortion Amplifier Gain potentiometer R237 for an exact full-scale reading.

h. Change input signal level to .3162 mV and set RATIO switch to .01%. Adjust Distortion Amplifier Gain potentiometer R239 for an exact full-scale reading.

3-29. TROUBLESHOOTING

Before attempting to troubleshoot the Model 1700A, ensure that the fault is with the Model 1700A and not caused by the test setup or associated equipment. The Performance Check (Paragraph 3-3 enables this to be determined without having to remove the covers from the Model 1700A.

If an abnormal condition is observed during the Performance Check, Table 3-2 will suggest remedies. However, before proceeding with detailed troubleshooting, note the following suggestions:

a. A good understanding of the principles of operation of the Model 1700A will assist the troubleshooter and it is recommended that the reader be familiar with the contents of Section II of this manual.

b. Any suspected malfunction should first be tested with the Performance Check. This need not be carried out in its entirety ---- only the portion applicable to the suspected malfunction should be performed.

c. Verify proper power supply operation by measuring the +15 Vdc and -15 Vdc voltages. Check also the +12, -6 and -8 Vdc supplies which operate the null control circuits on the analyzer board.

d. Many measurement problems or bad readings can be related to incorrect grounding. Refer to Paragraph 1-8 for correct grounding instructions.

e. The differential input circuitry of the Model 1700A requires a return to circuit common. Check the input cabling for proper connections.

f. Attempt to isolate the malfunction to either the oscillator or the distortion analyzer. After this, try to isolate the fault to a circuit block within the suspected unit.

g. Determine component failure within the analyzer by operating the Model 1700A without an input signal and then comparing dc levels with those marked on the schematic.

h. Since the instrument contains a number of identical components mounted in plug-in sockets, it is permissible to switch these units in order to isolate a malfunction. However, known good components must always be returned to their original locations.

i. Phase detector U303 in the tuning indicator need not be in position for proper notch filter operation. This component can therefore be used to isolate a malfunction in the null control circuits. But be sure to return the original I.C. to U303 when done.

j. Abnormally large potentials (more than ± 15 mV) measured between the + and - input terminals on operational amplifiers generally indicate a defective amplifier.

k. When a malfunction occurs try first to find out if the trouble relates to any particular pushbutton. If it does, it may be possible to cure the problem by depressing and releasing the defective button several times.

3-30. SYMPTOM/CAUSE TABLE

Table 3-2 contains symptoms of Model 1700A malfunctions and provides diagnostic tests for the location of these faults. Before beginning detailed troubleshooting, the reader is advised to study notes a. through k. in Paragraph 3-29.

Following the replacement of a defective component, refer to Paragraph 3-31 for instructions regarding any necessary calibration and/or adjustment procedures.

3-31. COMPONENT REPLACEMENT - CALIBRATION and ADJUSTMENT

Portions of the Model 1700A Adjustment and Calibration Procedure (Paragraphs 3-18) and other adjustments must be completed following the replacement of certain components in the instrument. These components, and the applicable Adjustment/Calibration Procedures are as listed below:

	Component	Required Adjustment/Calibration Procedure
a.	Photocoupler U7 (Oscillator)	Oscillator Integrator Output Adjustment (Paragraph 3-22)
b.	Voltage - controlled resistor Q1 (Oscillator)	Oscillator Integrator Voltage Change Adjustment (Paragraph 3-21)
c.	Operational Amplifier U1 (Oscillator)	Oscillator X1000 Frequency Range Adjustment (Paragraph 3-23)
d.	Operational Amplifiers 2605, 2625 (Analyzer)	DC Zero Adjustment - related adjustment (Paragraph 3-25)
e.	Meter M1 (Analyzer)	Calibration at 1 kHz (Paragraph 3-28)
f.	Phase detectors U307, U310 (Analyzer, null control)	Null Adjustment (Paragraph 3-26)
g.	Phase detector U303 (Analyzer, tuning Indicator)	Tuning Indicator Adjustment (Paragraph 3-27)
h.	Photocoupler U205 (Analyzer, phase null control)	Allow 10 minutes for the photocoupler to cool off after soldering. Phase Null Integrator Voltage Adjustment (Paragraph 3-26A).

i.	Photocoupler U206 (Analyzer, amplitude null control)	Allow 10 minutes for the photocoupler to cool off after soldering. Set controls as described above. Connect DVM HI lead to TP8 and LO lead to TP7. Reading is dc voltage across R359. Calculate current through it. If necessary, select new value for R359, such that 1.4 $\pm$ .2 V is developed across it. Replace R359.

3-32. REPLACEMENT and REPAIR

3-33. SPECIAL PRECAUTIONS

3-34. Contamination

The performance of the Model 1700A will be greatly degraded by contamination of the circuit-board surfaces or components. Finger marks and oil droplets are contaminants to be especially avoided. To minimize the possibility of contamination, observe the following precautions:

a. Do not disassemble any portion of the Model 1700A unless absolutely necessary (for example, to replace relays on oscillator board or to service frequency modules.)

b. Avoid any unnecessary handling of the printed-circuit boards or components. Replace components from the top side of the boards only.

c. Employ only the soldering and component replacement techniques described in Paragraphs 3-36 through 3-39.

3-35. WIRING

Lead dress within the instrument should not be altered. This is especially important with the wires running between the rotary switches and the distortion analyzer assembly. Before removing an assembly with wires attached, make a sketch showing the exact arrangement of the wires so that they may be replaced in the same manner.

3-36. SOLDERING TECHNIQUES

a. Use a low-wattage iron with a pencil-shaped tip and allow it to reach full operating temperature before use. A fully-heated iron ensures the quick completion of soldering and minimizes the chance that the etched wiring on the printed-circuit boards will be damaged by excessive heat.

b. Before using the soldering iron, wipe it off to remove excess solder and oxide.

c. Use only a solder with non-corrosive non-conductive flux. Do not use acid-cored solder.

d. Do not clean off the rosin around the soldered joint with a wire brush or metal scribe. This will destroy the high electrical resistance of the board.

3-37. COMPONENT REPLACEMENT

CAUTION

The use of Soder-Wick* (rosin-impregnated copper braid) or a similar product is highly recommended for the removal of solder during the de-soldering operation. If it is not available, and a vacuum-type de-soldering tool is employed, ensure that it is cleaned before use. This is to prevent the possibility of conductive debris being sprayed on the board during the de-soldering process.

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*Soder-Wick may be obtained from Solder Removal Company, Covina, CA, U.S.A.

Table 3-2

SYMPTOM	PROBABLE CAUSE	DIAGNOSTIC TEST
Oscillator will not settle down to low distortion mode	Photo-coupler, U7	Replace photo-coupler
	VCR, Q1	Replace VCR
	R7 out of adjustment	Do oscillator Integrator Change Adjustment (Paragraph 3-21)
	Dual Timer, U6	Replace U6
	Oscillator amp. U1	Replace U1
Oscillator has excessive unstable distortion readings	Photo-coupler, U7	Replace U7
	VCR, Q1	Replace Q1
	Oscillator amp., U1	Replace U1
Oscillator has excessive third harmonic distortion	Photo-coupler, U7	Replace U7
Oscillator produces clipped waveforms	Photo-coupler, U7	Replace U7
	RC filter amplifier, U2	Replace U2
	Integrator Amplifier, U3	Replace U3
	Oscillator Amp., U1	Replace U1
	Peak detectors, Q2, Q3	Replace Q2 or Q3
Oscillator has no output on all frequencies	Oscillator Amp., U1	Replace U1
Oscillator has hum output	Improper ground connections or Float switch set to ground (⏚) position	Check that ground and connections are in compliance with Paragraphs 1-8 and 1-9
Hum in distortion output	Missing chassis connection between 1700A and scope	Check that connections are in compliance with Paragraphs 1-8 and 1-9
Distortion reading contains excessive hum	Missing ground return for 1700A differential front end	Check that connections are in compliance with Paragraphs 1-8 and 1-9
High distortion reading under all conditions (Not Nulling)	Amplitude Null Circuit (U302, U310, U311, U312)	Check D.C. voltages on Null circuit without input signal
	Photo-coupler, U206	Replace U206
	Phase Null Circuit (U306, U307, U308, U309)	Check D.C. voltages on Null circuit without input signal
	Photo-coupler, U205	Replace U205

Table 3-2, Continued

SYMPTOM	PROBABLE CAUSE	DIAGNOSTIC TEST
High distortion reading under all conditions (Not Nulling), Cont.	Notch Filter (U201, U202, U203, U301)	Open feedback loop by lifting up one end of R203 (100 ohms). Check D.C. voltages on Notch Filter circuit without input signal
	Leaky zener diode CR304 or CR305	Disconnect zener from circuit while operating in Distortion Function
One of Notch frequency lights stays ON during measurement on all frequencies	Tuning indicator circuit (U303, U304, U305)	Check D.C. voltages on circuit without input signal
	Phase detector, U303	Replace U303
	R312 out of adjustment	Do tuning indicator adjustment (Paragraph 3-27)
Analyzer has excessive unstable distortion readings	Photo-coupler U205 or U206	Make certain the symptom is from the analyzer section and not the oscillator section. Then replace U205 or U206
One of notch frequency lights stays ON during distortion measurement on some frequencies	Oscillator frequency drifted out of $\pm$ 2% limit	Check oscillator frequency with counter
	R312 out of adjustment	Do tuning indicator adjustment (Paragraph 3-27)
	Range capacitor(s) or digit resistor(s) drifted out of in analyzer section	Unsolder range capacitor(s) from P.C. board to measure value. Check the suspected resistor(s) by actuating proper pushbutton(s) and measure at analyzer P.C. board.
Nulling becomes excessively slow	Oscillator drifted up in frequency	Check frequency with counter
	Photocoupler U205 or U206 characteristic changed causing a high integrator voltage	Do Phase Null Integrator Voltage Adjustment (Paragraph 3-26A. Check D.C. voltage at TP8 with respect to TP7. If voltage is greater than 6 volts, change R359 according to procedure described in 3-31-i. If new R359 $\leq$ 500 ohms, change U206.
Not Nulling on some frequencies	Bad contact in pushbutton switch	Refer to Troubleshooting Paragraph 3-29-k

3-38. Multi-Lead Devices

Follow the instructions given below when replacing multi-lead components on the printed-circuit boards:

a. Cut all leads to remove device from P.C. board. The pieces of the leads that remain can then be unsoldered from the board.

CAUTION

Be sure to hold each lead with needle-nose pliers when it is unsoldered. This is to prevent the possibility of a lead dropping through a hole and shorting traces below the board.

b. Using Solder-Wick, remove remaining solder from component holes.

c. When replacing a device, ensure that the length of its leads match the length of the leads on the device removed. Do not push the new device too far down into board as this may cause a short to the metal deck below. The clearance between the boards and the metal deck is 1/4 inch.

3-39. Potentiometers

The small black rectangular potentiometers are attached to the printed-circuit boards by three leads projecting from their lower surface in line with the numbers "1", "2", and "3" marked on top. To remove this type of potentiometer, proceed as follows:

a. Carefully raise side of potentiometer opposite numbers until leads below are visible.

b. Continue bending leads until there is sufficient clearance for tip of soldering iron.

c. Unsolder potentiometer following instructions given in Paragraph 3-38.

d. Install replacement component following reverse procedure.

3-40. Power Supply

The majority of the components on the power supply assembly may be replaced without removing the board from its location on the rear panel. However, if additional access is required proceed as follows:

a. Remove bottom cover from Model 1700A and remove retaining screws securing power supply board to rear panel.

b. Slide power supply board forward through bottom of instrument as far as wires attached to it will allow.

3-41. FREQUENCY MODULE REPAIR

3-42. General

The following procedure details step by step instructions for disassembly and repair of the instrument's frequency module. It is recommended that this procedure be closely followed and performed only by personnel familiar with electronic equipment disassembly/assembly techniques.

3-43. Removal/Replacement

CAUTION

Certain subassemblies in the instrument are secured with hardware which includes insulating washers. Note the location of these washers when disassembling the unit and replace them in the same locations on reassembly. Failure to observe this precaution will result in improper operation of the instrument.

a. Remove top and bottom covers and place instrument on clean work surface.

b. Remove four screws securing right side brace (side nearest power transformer) to front and rear panels.

c. Remove three screws securing deck and switch bracket in the bottom channel of right side brace.

d. Remove handle caps and two screws securing handle to right side brace.

e. Remove two screws securing analyzer deck to rear panel.

f. Remove two screws securing left side brace to rear panel.

g. Pull back rear panel and slide out brown handle plate on right side brace.

h. Remove screw (which was beneath brown handle plate) securing switch bracket to right side brace.

i. Remove four screws securing power supply assembly to rear panel. Move power supply to allow access to oscillator deck screws.

j. Remove two screws securing oscillator deck to center divider.

k. Remove two screws securing switch bracket to center divider.

l. Carefully withdraw oscillator portion of frequency module from instrument. Unsolder wires attached to assembly if complete removal is desired.

NOTE

The wires are color-coded for attachment to the numbered holes in the printed circuit board; black = 0, brown = 1, red = 2, orange = 3, yellow = 4, etc.

m. Remove four nuts securing analyzer portion of frequency module to front panel. Slide assembly back for access and unsolder wires if complete removal is required.

n. Replace analyzer and oscillator frequency module assemblies and reassemble instrument following reverse procedure.

NOTE

1. When replacing analyzer portion of frequency module, line up pushbuttons with openings in front panel.

2. When replacing oscillator portion of frequency module, line up pushbars vertically with the rear of the pushbars of the analyzer section. Ensure also that there is a .015 inch clearance between the analyzer and oscillator pushbars, with the pushbuttons in undepressed position. See Figure 3-2 for details.

3-44. Repair Instructions

CAUTION

Field repair of the frequency module is limited to replacement of defective RC components on the switch boards. Replacement of pushbutton switches is not recommended -- order a replacement switch board from the factory.

a. Remove bus wires running between boards, using multi-lead component desoldering technique described in this section of the manual.

b. Detach board containing defective components from switch bracket and replace component.

c. Reassemble module, replacing bus wires removed in step a.

NOTE

1. Spacing between boards must be 25/32 inch (inside to inside dimension) to ensure proper alignment.

2. Boards must be perpendicular to switch mounting bracket.

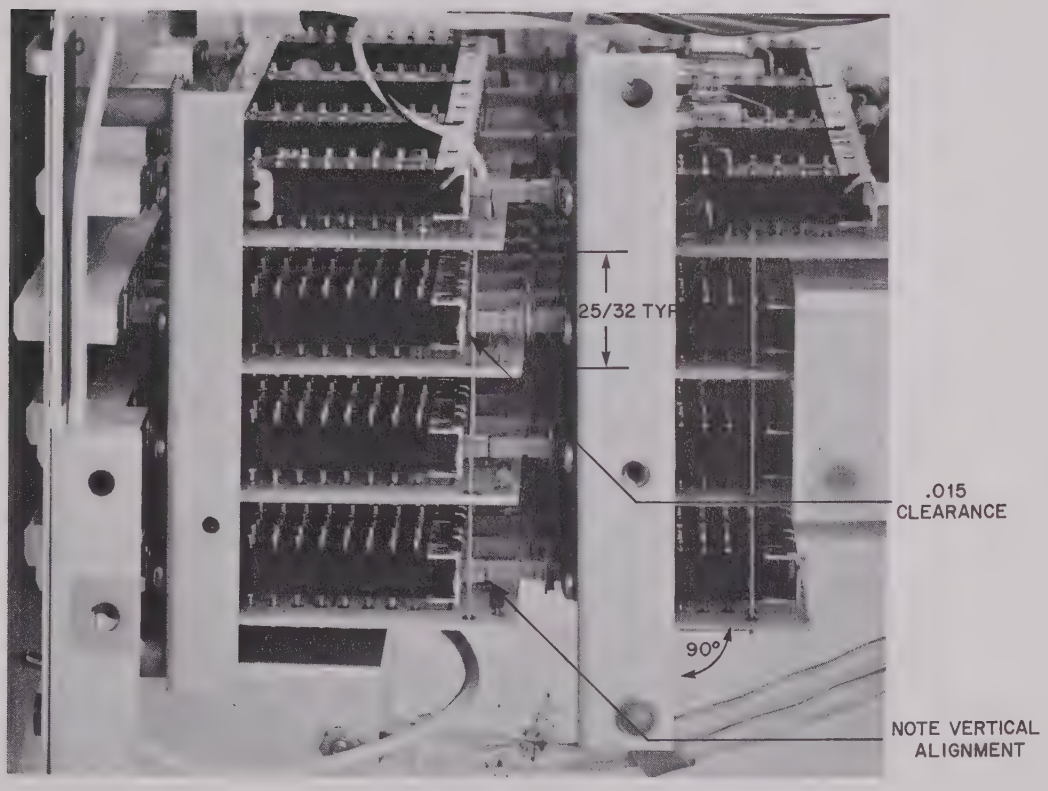


FIG. 3-2

SECTION IV
DIAGRAMS

4-1. INTRODUCTION

This section contains the circuit diagrams necessary for the operation and maintenance of the Model 1700A. Included are schematic diagrams and component location diagrams.

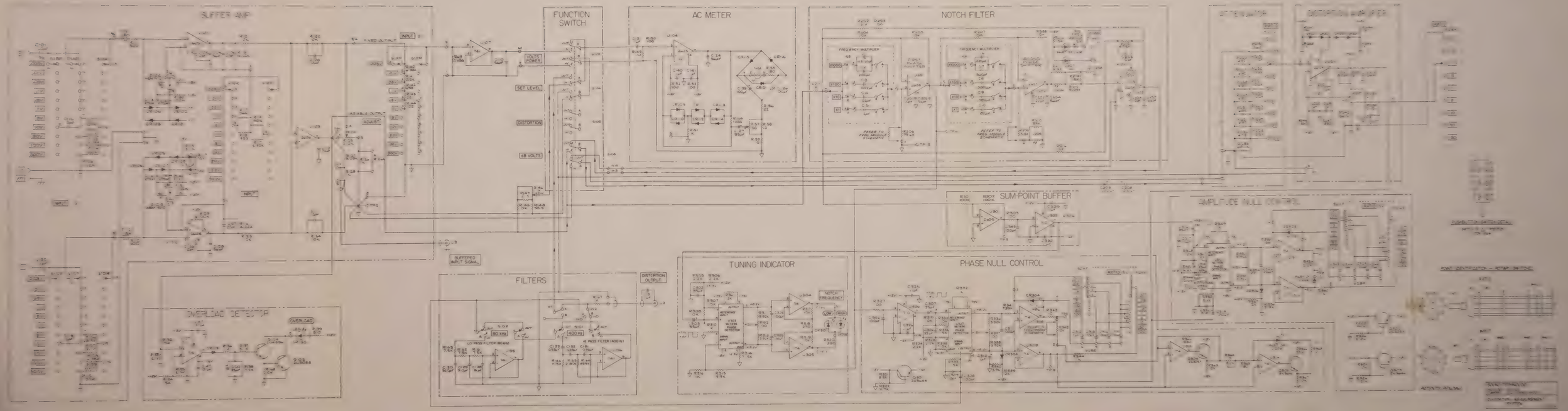
4-2. SCHEMATIC DIAGRAMS

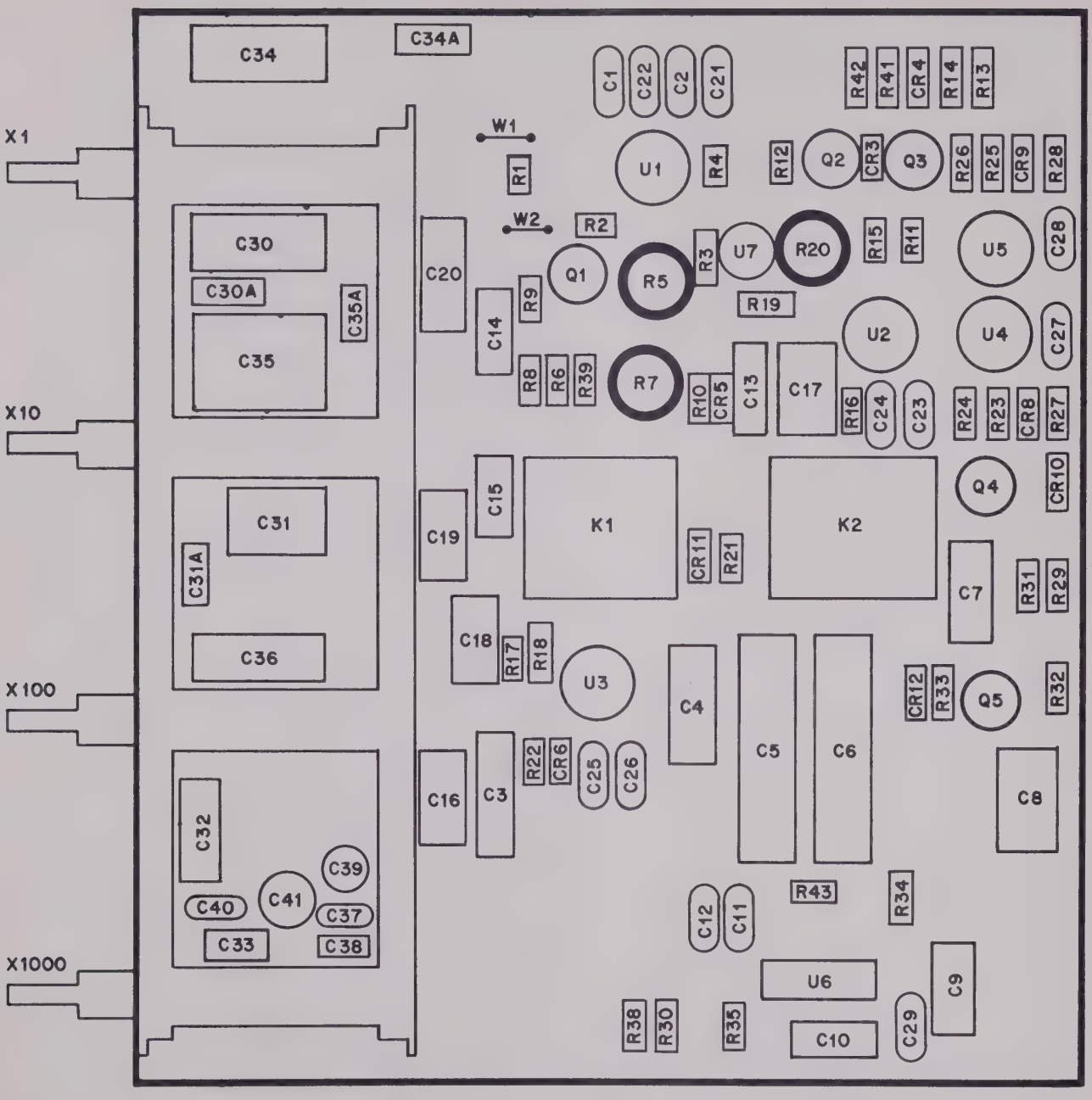
The circuitry contained within each assembly is shown in the schematic diagrams. As an aid to isolating malfunctions, the diagrams also provide typical operating voltages and wave-forms.

4-3. COMPONENT LOCATION DIAGRAMS

The component location diagrams show the physical location of parts mounted on each assembly. Each part is identified by a reference designator, similarly identified on the schematic diagrams and in the parts list.

FIG. 4-1 ANALYZER BOARD


BUFFER AMP
FUNCTION SWITCH
AC METER
NOTCH FILTER
ATTENUATOR
DISTORTION AMPLIFIER
SUM-POINT BUFFER
AMPLITUDE NULL CONTROL
PHASE NULL CONTROL
TUNING INDICATOR
FILTERS
OVERLOAD DETECTOR
INPUT
VOLTS/POWER
SET LEVEL
DISTORTION
48 VOLTS
BUFFERED INPUT SIGNAL
DISTORTION OUTPUT
OVERLOAD
80 KHz
400 Hz
LO PASS FILTER (80 kHz)
HI PASS FILTER (400 Hz)
NOTCH FREQUENCY
RATIO
ADJUST



SOUND TECHNOLOGY
1400 DELL AVENUE
CAMPBELL, CALIFORNIA 95008

OSCILLATOR BOARD

4-11-75

FIG. 4-3

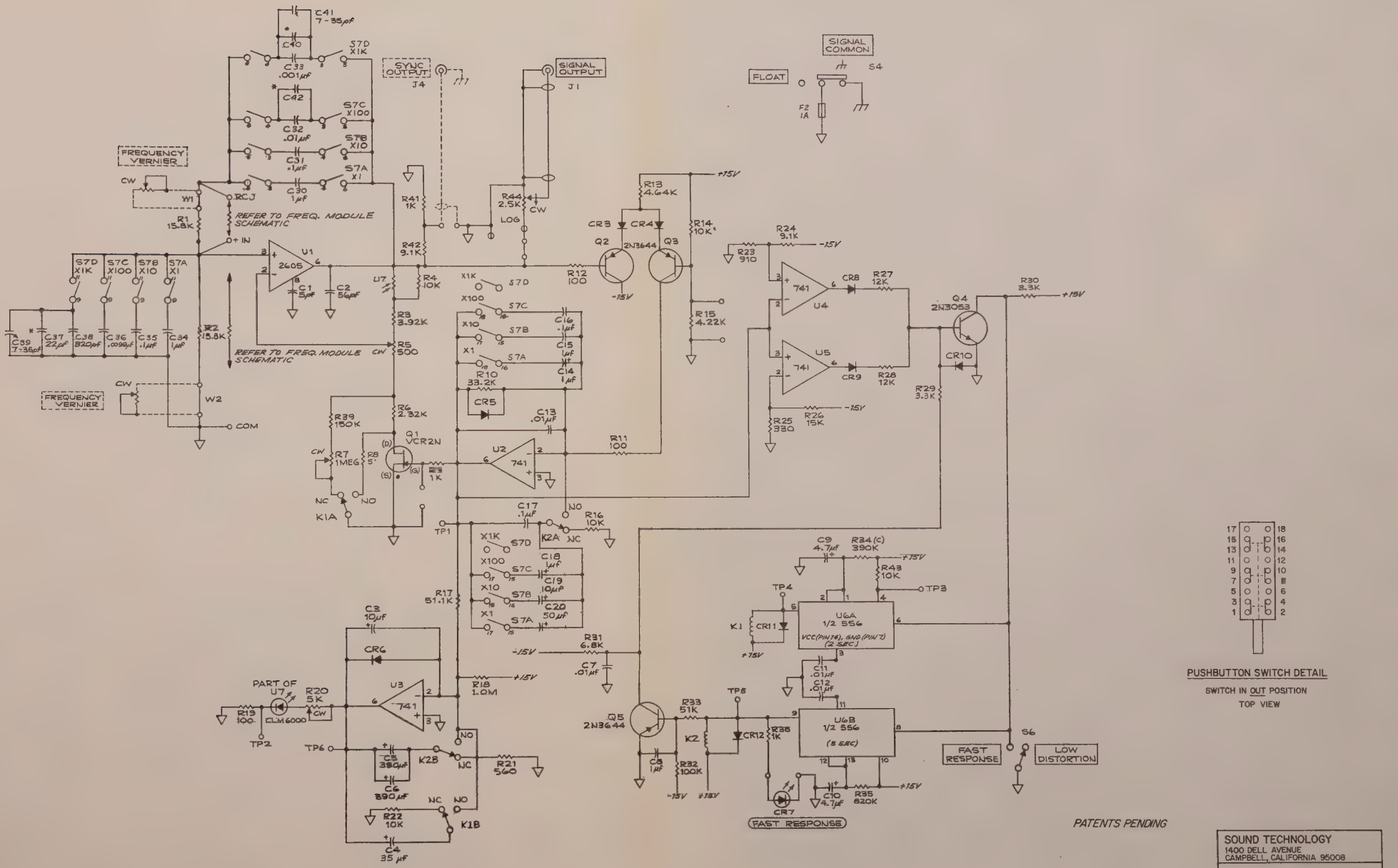
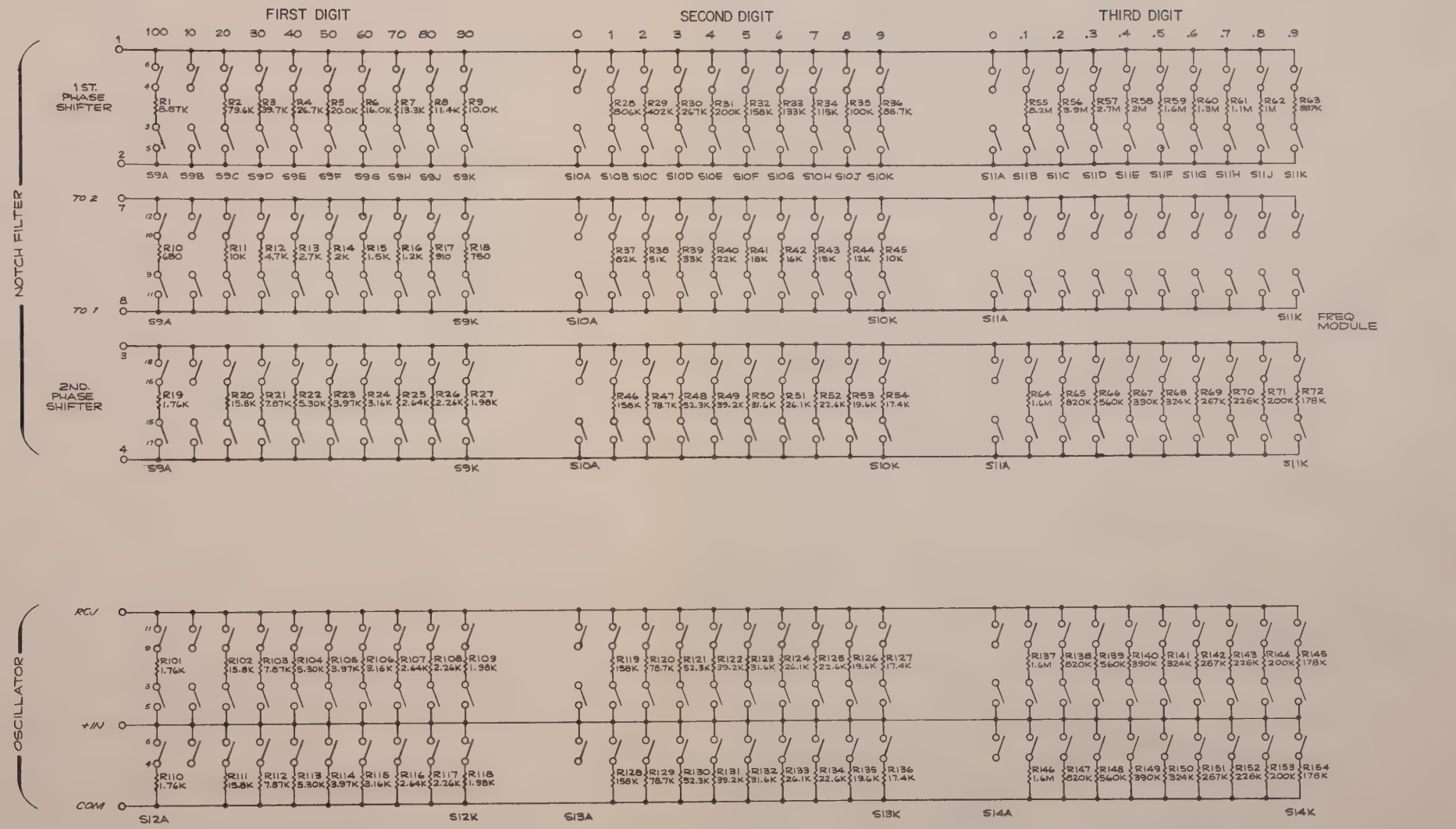

C41 7-35pf
C40
S7D X1K
C33 .001µf
C42
S7C X100
C32 .01µf
S7B X10
C31 .1µf
S7A X1
C30 1µf
SYNC OUTPUT J4
SIGNAL OUTPUT J1
SIGNAL COMMON
FLOAT
S4
F2 1A
FREQUENCY VERNIER
CW
W1
RCJ
R1 15.8K
REFER TO FREQ. MODULE SCHEMATIC
+ IN
U1 2605
C1 5µf
C2 56µf
R41 1K
R42 9.1K
R44 2.5K LOG CW
R12 100
R13 4.64K
+15V
CR3 CR4
Q2 2N3644 Q3
-15V
R14 10K
R15 4.22K
R24 9.1K
R23 910
-15V
U4 741
CR8
R27 12K
R30 3.3K
Q4 2N3053
+15V
CR10
U5 741
CR9
R28 12K
R29 3.3K
R25 330
R26 15K
-15V
C39 7-35pf
C37 22µf
C38 820pf
C36 .0096µf
C35 .1µf
C34 1µf
R2 15.8K
R3 3.92K
R4 10K
U7
X1K S7D
X100 S7C
X10 S7B
X1 S7A
C16 .1µf
C15 1µf
C14 1µf
R10 33.2K
CR5
C13 .01µf
R5 500
CW
W2
COM
R6 2.32K
R39 150K
Q1 VCR2N
R7 1MEG
R8 5'
R11 100
U2 741
R3 1K
NC NO
K1A
C17 .1µf
R16 10K
K2A
TP1
C18 1µf
C19 10µf
C20 50µf
R17 51.1K
C3 10µf
CR6
U3 741
R18 1.0M
PART OF U7
R20 5K
R19 100
ELM6000
TP2
TP6
C5 390µf
C6 390µf
K2B
R21 560
R22 10K
K1B
C4 35 µf
R31 6.8K
C7 .01µf
Q5 2N3644
R33 51K
K2
CR12
R36 1K
C8 1µf
R32 100K
C9 4.7µf
R34(C) 390K
R43 10K
TP4
TP3
K1
CR11
U6A 1/2 556
VCC(PIN 14), GND(PIN 7) (2 SEC)
C11 .01µf
C12 .01µf
TP5
U6B 1/2 556
(5 SEC)
C10 4.7µf
R35 820K
CR7
FAST RESPONSE
S6
FAST RESPONSE
LOW DISTORTION
PUSHBUTTON SWITCH DETAIL
SWITCH IN OUT POSITION
TOP VIEW
PATENTS PENDING
SOUND TECHNOLOGY
1400 DELL AVENUE
CAMPBELL, CALIFORNIA 95008
OSCILLATOR
1-28-75

FIG. 4-4



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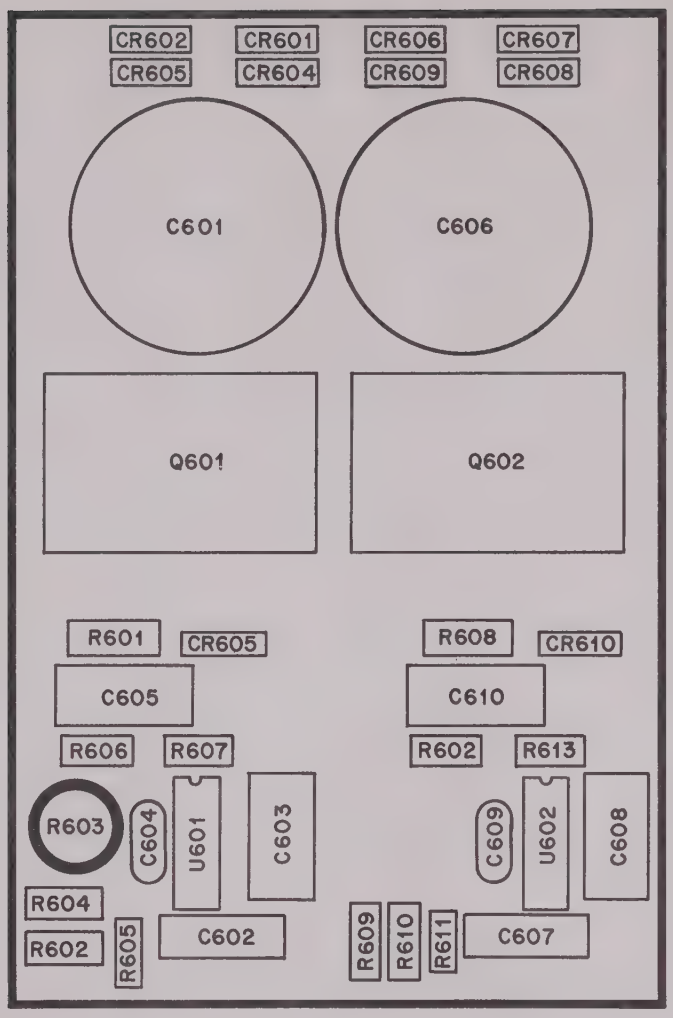
FREQUENCY MODULES 1-28-75

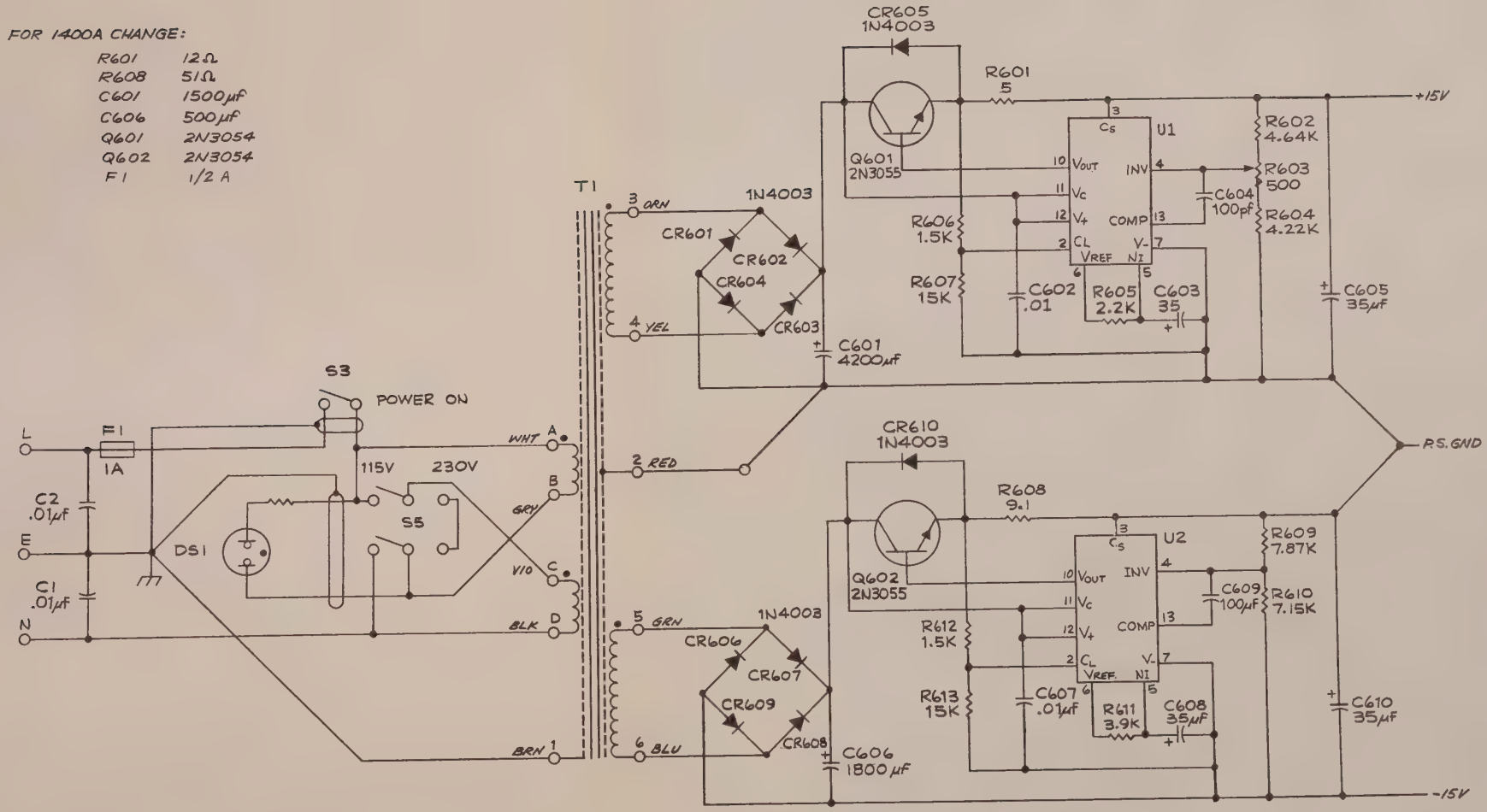
FIG. 4-5



SOUND TECHNOLOGY
1400 DELL AVENUE
CAMPBELL, CALIFORNIA 95008

POWER SUPPLY BOARD
12-11-74

FIG. 4-6



SOUND TECHNOLOGY 1400 DELL AVENUE CAMPBELL, CALIFORNIA 95008
POWER SUPPLY 1-28-75

FIG. 4-7

SECTION V - SPARE PARTS

5-1. INTRODUCTION

This section contains information for ordering replacement parts, and provides the following details:

a. The Sound Technology part number.

b. Circuit diagram reference designator.

c. General description of part.

d. Total quantities used.

5-2. ORDERING INFORMATION

When ordering replacement parts, each part must be identified by a Sound Technology part number. To order a part include the following information:

a. Instrument model number.

b. Instrument serial number.

c. Description of part.

d. Function and location of part.

Address your order or inquiry to:

Sound Technology
1400 Dell Avenue
Campbell, California 95008

(408) 378-6540

5-3. PARTS LIST

1700A DISTORTION ANALYZER, CHASSIS

	PART NO	DESCRIPTION	QTY
CR7, 120, 301, 302	0300-0000	DIODE-LED RED	4.0
R125	1400-0001	RES-VAR 2K 10% 2W CARB	1.0
R44	1400-0002	RES-VAR 2.5K 10% 2W LOG CARB	1.0
C3	2020-0004	CAP-FXD 1UF 10% 100V TUBULAR	1.0
C101, 102	2020-0005	CAP-FXD 1UF 10% 400V TUBULAR	2.0
C1, 2	2040-0001	CAP-FXD 0.01UF 2KV CERAMIC	2.0
S3	3000-0001	SWITCH-TOGGLE	1.0
S6	3005-0000	SWITCH-SLIDE DPDT	2.0
S5	3005-0001	SWITCH-SLIDE,LINE SELECT	1.0
	3100-0000	CONNECTOR-BNC JACK,SHORT	1.0
	3100-0001	CONNECTOR-BNC JACK,LONG	2.0
	3110-0000	CONNECTOR-AC RECEPTACLE	1.0
	3110-0001	CONNECTOR-BINDING POST, BROWN	4.0
T1	3200-0000	TRANSFORMER-POWER 1400A, 1700A	1.0
M1	3320-0000	METER-1MA, VRMS,PWR,DB	1.0
DS1	3440-0000	LAMP-NEON, AMBER	1.0
	3445-0001	CONNECTOR-LAMP	1.0
	3445-0002	RETAINING CLIP-LAMP	1.0
F1	3480-0002	FUSE-1 AMP, 3AG	1.0
	3485-0000	FUSE HOLDER, 3AG	1.0
	7100-0000	CABLE ASSY-LINE CORD	1.0

01700-30009 ASSY-PC, PWR SUP

	PART NO	DESCRIPTION	QTY
Q601, 602	0005-0001	TRANS-POWER 2N3055 NPN SI	2.0
U1, 2	0100-0012	IC-REGULATOR 723, DIP 14 PIN	2.0
CR601-610	0200-0001	DIODE-RECT 1N4003 SI	10.0
R604	1015-1422	RES-FXD 4.22K 1% 1/8W MF	1.0
R602	1015-1464	RES-FXD 4.64K 1% 1/8W MF	1.0
R610	1015-1715	RES-FXD 7.15K 1% 1/8W MF	1.0
R609	1015-1787	RES-FXD 7.87K 1% 1/8W MF	1.0
R606, 612	1100-1150	RES-FXD 1.5K 5% 1/4W	2.0
R605	1100-1720	RES-FXD 2.2K 5% 1/4W	1.0
R611	1100-1390	RES-FXD 3.9K 5% 1/4W	1.0
R607, 613	1100-2150	RES-FXD 15K 5% 1/4W	2.0
R608	1110-4000	RES-FXD 9.1 OHM, 5%, 1W	1.0
R601	1200-1000	RES-FXD 5 2W WW	1.0
R603	1410-0002	RES-VAR 500 TRIMPOT CERMET	1.0
R604, 609	2000-0100	CAP-FXD 100PF 5% 500V MICA	2.0
C602, 607	2020-0000	CAP-FXD 0.01UF 10% 100V MYLAR	2.0
C603, 605, 608, 610	2100-0004	CAP-FXD 35UF 25V ELECT AL	4.0
C606	2100-0009	CAP-FXD 1800-2500UF 40-50V EL	1.0
C601	2100-0010	CAP-FXD 3000-4200UF 40-50V EL	1.0
	3150-0005	INSULATOR- TO-3 TRANSISTOR	2.0
	3150-0007	INSULATOR-TRANS, TO-3 NYLON	1.0
	3600-0001	HEAT SINK-TO3	2.0

81700-30003 ASSY-PC, OSCILLATOR

	PART NO	DESCRIPTION	QTY
Q2, 3, 5	0000-0001	TRANS 2N3644 PNP SI	3.0
Q4	0005-0000	TRANS 2N3053 NPN SI	1.0
Q1	0025-0000	TRANS-FET VCR2N N-CHAN	1.0
U2-5	0100-0001	IC-OP AMP 741	4.0
U1	0100-0007	IC-OP AMP 2605 GRADE 2	1.0
U6	0110-0000	IC-TIMER 556	1.0
CR3-6, 8-12	0200-0000	DIODE-GEN 1N914A SI	9.0
U7	0305-0002	PHOTOCELL--LED GRADE 2	1.0
R1, 2	1005-2158	RES-FXD 15.8K 0.25% 1/8W MF	2.0
R19	1015-0100	RES-FXD 100 1% 1/8W MF	1.0
R6	1015-1232	RES-FXD 2.32K 1% 1/8W MF	1.0
R3	1015-1392	RES-FXD 3.92K 1% 1/8W MF	1.0
R15	1015-1422	RES-FXD 4.22K 1% 1/8W MF	1.0
R13	1015-1464	RES-FXD 4.64K 1% 1/8W MF	1 0
R14	1015-2100	RES-FXD 10K 1% 1/8W MF	1.0
R10	1015-2332	RES-FXD 33.2K 1% 1/8W MF	1.0
R17	1015-2511	RES-FXD 51.1K 1% 1/8W MF	1.0
R18	1015-4100	RES-FXD 1M 1% 1/8W MF	1.0
R8	1100-0051	RES-FXD 51 5% 1/4W	1.0
R11, 12	1100-0100	RES-FXD 100 5% 1/4W	2.0
R25	1100-0330	RES-FXD 330 5% 1/4W	1.0
R21	1100-0560	RES-FXD 560 5% 1/4W	1.0
R23	1100-0910	RES-FXD 910 5% 1/4W	1.0
R9, 38, 41	1100-1100	RES-FXD 1K 5% 1/4W	3.0
R29, 30	1100-1330	RES-FXD 3.3K 5% 1/4W	2.0
R31	1100-1680	RES-FXD 6.8K 5% 1/4W	1.0
R24, 42	1100-1910	RES-FXD 9.1K 5% 1/4W	2.0
R16, 22, 43	1100-2100	RES-FXD 10K 5% 1/4W	4.0
R27, 28	1100-2120	RES-FXD 12K 5% 1/4W	2.0
R26	1100-2150	RES-FXD 15K 5% 1/4W	1.0
R33	1100-2510	RES-FXD 51K 5% 1/4W	1.0
R32	1100-3100	RES-FXD 100K 5% 1/4W	1.0
R39	1100-3150	RES-FXD 150K 5% 1/4W	1.0
R34	1100-3390	RES-FXD 390K 5% 1/4W	1.0
R35	1100-3820	RES-FXD 820K 5% 1/4W	1.0
R5	1410-0002	RES-VAR 500 TRIMPOT CERMET	1.0
R20	1410-0004	RES-VAR 5K TRIMPOT CERMET	1.0
R7	1410-0006	RES-VAR 1M TRIMPOT CERMET	1.0
C1	2000-0005	CAP-FXD 5PF 10% 500V MICA	1.0
C37, 40	2000-0022	CAP-FXD 22PF 5% 500V MICA	2.0
C2	2000-0056	CAP-FXD 56PF 5% 500V MICA	1.0
C7, 13	2020-0000	CAP-FXD 0.01UF 10% 100V MYLAR	2.0
C16, 17	2020-0003	CAP-FXD 0.1UF 10% 100V MYLAR	2.0
C33	2025-0000	CAP-FXD 0.001UF 1% 33V PLYSTR	1.0
C32	2025-0003	CAP-FXD 0.01UF 1% 33V PLYSTR	1.0
C31, 35	2025-0006	CAP-FXD 0.1UF 1% 33V PLYSTR	2.0
C30, 34	2025-0009	CAP-FXD 1.007UF 1% PLYSTR	2.0
C30A, 34A	2025-0016	CAP-FXD .0068UF 2.5% 63V PYSTR	2.0
C36	2025-0018	CAP-FXD 0 0099UF 1% 63V PLYSTR	1.0
C31A, 35A	2025-0019	CAP-FXD 680PF 63V 2.5% PLYSTR	2.0
C38	2025-0023	CAP-FXD 820PF 1% 63V PLYSTR	1.0
C11, 12, 21-29	2040-0000	CAP-FXD 0.01UF 100V CERAMIC	10.0
C9, 10	2100-0000	CAP-FXD 4.7UF 10% 35V TANT	2.0
C8, 14, 15, 18	2100-0001	CAP-FXD 1UF 25V ELECT AL	4.0
C3, 19	2100-0003	CAP-FXD 10UF 25V ELECT AL	2.0
C20	2100-0004	CAP-FXD 35UF 25V ELECT AL	1.0
C4	2100-0005	CAP-FXD 50UF 25V ELECT AL	1.0
C5, 6	2100-0008	CAP-FXD 390UF 12V ELECT AL	2.0
C39, 41	2205-0004	CAP-VAR 7-35PF TRIMMER CERAMIC	2.0
S7	3015-0002	SWITCH-PB, 4 STA(2 SPACE)-6P	1.0
K1, 2	3400-0000	RELAY-2 FORM C	2.0
	3600-0000	HEAT SINK-ROUND FINNED TO5	1 0

01700-30002 ASSY-PC, OSC FREQ 1ST DIGIT

	PART NO	DESCRIPTION	QTY
R101, 110	1005-1176	RES-FXD 1.76K 0.25% 1/8W MF	2.0
R109, 118	1005-1198	RES-FXD 1.98K 0.25% 1/8W MF	2.0
R108, 117	1005-1226	RES-FXD 2.26K 0.25% 1/8W MF	2.0
R107, 116	1005-1264	RES-FXD 2.64K 0.25% 1/8W MF	2.0
R106, 115	1005-1316	RES-FXD 3.16K 0.25% 1/8W MF	2.0
R105, 114	1005-1397	RES-FXD 3.97K 0.25% 1/8W MF	2.0
R104, 113	1005-1530	RES-FXD 5.30K 0.25% 1/8W MF	2.0
R103, 112	1005-1787	RES-FXD 7.87K 0.25% 1/8W MF	2.0
R102, 111	1005-2158	RES-FXD 15.8K 0.25% 1/8W MF	2.0
	3015-0003	SWITCH-PB, 10 STA-4P	1.0

01700-30012 ASSY-PC, OSC FREQ 2ND DIGIT

	PART NO	DESCRIPTION	QTY
R127, 136	1005-2174	RES-FXD 17.4K 0.25% 1/8W MF	2.0
R126, 135	1005-2196	RES-FXD 19.6K 0.25% 1/8W MF	2.0
R125, 134	1005-2226	RES-FXD 22.6K 0.25% 1/8W MF	2.0
R124, 133	1015-2261	RES-FXD 26.1K 1% 1/8W MF	2.0
R123, 132	1015-2316	RES-FXD 31.6K 1% 1/8W MF	2.0
R122, 131	1015-2392	RES-FXD 39.2K 1% 1/8W MF	2.0
R121, 130	1015-2523	RES-FXD 52.3K 1% 1/8W MF	2.0
R120, 129	1015-2787	RES-FXD 78.7K 1% 1/8W MF	2.0
R119, 128	1015-3158	RES-FXD 158K 1% 1/8W MF	2.0
S13	3015-0003	SWITCH-PB, 10 STA-4P	1.0

01700-30013 ASSY-PC, OSC FREQ 3RD DIGIT

	PART NO	DESCRIPTION	QTY
R145, 154	1015-3178	RES-FXD 178K 1% 1/8W MF	2.0
R144, 153	1015-3200	RES-FXD 200K 1% 1/8W MF	2.0
R143, 152	1015-3226	RES-FXD 226K 1% 1/8W MF	2.0
R142, 151	1015-3267	RES-FXD 267K 1% 1/8W MF	2.0
R141, 150	1015-3324	RES-FXD 324K 1% 1/8W MF	2.0
R140, 149	1100-3390	RES-FXD 390K 5% 1/4W	2.0
R139, 148	1100-3560	RES-FXD 560K 5% 1/4W	2.0
R138, 147	1100-3820	RES-FXD 820K 5% 1/4W	2.0
R137, 146	1100-4160	RES-FXD 1.6M 5% 1/4W	2.0
S14	3015-0003	SWITCH-PB, 10 STA-4P	1.0

01700-30005 ASSY-PC, ANAL MULTIPLIER

	PART NO	DESCRIPTION	QTY
C2	2005-0000	CAP-FXD 200PF 1% 500V MICA	1.0
C6	2005-0001	CAP-FXD 220PF 1% 500V MICA	1.0
C7	2005-0002	CAP-FXD 560PF 1% 500V MICA	1.0
C3	2025-0001	CAP-FXD 0.002UF 1% 33V PLYSTR	1.0
C8	2025-0002	CAP-FXD 0.0082UF 1% 33V PLYSTR	1.0
C4	2025-0004	CAP-FXD 0.02UF 1% 33V PLYSTR	1.0
C9	2025-0005	CAP-FXD 0.082UF 1% 33V PLYSTR	1.0
C5	2025-0007	CAP-FXD 0.2UF 1% POLYSTR	1.0
C10	2025-0008	CAP-FXD 0.82UF 1% POLYSTR	1.0
C1	2205-0000	CAP-VAR 4.5-20PF TRIMMER CER	1.0
S8	3015-0002	SWITCH-PB, 4 STA(2 SPACE)-6P	1.0

01700-30004 ASSY-PC,

ANAL FREQ 1ST DIGIT

	PART NO	DESCRIPTION	QTY
R19	1005-1176	RES-FXD 1.76K 0.25% 1/8W MF	1.0
R27	1005-1198	RES-FXD 1.98K 0.25% 1/8W MF	1.0
R26	1005-1226	RES-FXD 2.26K 0.25% 1/8W MF	1.0
R25	1005-1264	RES-FXD 2.64K 0.25% 1/8W MF	1.0
R24	1005-1316	RES-FXD 3.16K 0.25% 1/8W MF	1.0
R23	1005-1397	RES-FXD 3.97K 0.25% 1/8W MF	1.0
R22	1005-1530	RES-FXD 5.30K 0.25% 1/8W MF	1.0
R21	1005-1787	RES-FXD 7.87K 0.25% 1/8W MF	1.0
R1	1005-1887	RES-FXD 8.87K 0.25% 1/8W MF	1.0
R9	1005-2100	RES-FXD 10K 0.25% 1/8W MF	1.0
R8	1005-2114	RES-FXD 11.4K 0.25% 1/8W MF	1.0
R7	1005-2133	RES-FXD 13.3K 0.25% 1/8W MF	1.0
R20	1005-2158	RES-FXD 15.8K 0.25% 1/8W MF	1.0
R6	1005-2160	RES-FXD 16.0K 0.25% 1/8W MF	1.0
R5	1005-2200	RES-FXD 20K 0.25% 1/8W MF	1.0
R4	1005-2267	RES-FXD 26.7K 0.25% 1/8W MF	1.0
R3	1005-2397	RES-FXD 39.7K 0.25% 1/8W MF	1.0
R2	1005-2796	RES-FXD 79.6K 0.25% 1/8W MF	1.0
R10	1100-0680	RES-FXD 680 5% 1/4W	1.0
R18	1100-0750	RES-FXD 750 5% 1/4W	1.0
R17	1100-0910	RES-FXD 910 5% 1/4W	1.0
R16	1100-1120	RES-FXD 1.2K 5% 1/4W	1.0
R15	1100-1150	RES-FXD 1.5K 5% 1/4W	1.0
R14	1100-1200	RES-FXD 2K 5% 1/4W	1.0
R13	1100-1270	RES-FXD 2.7K 5% 1/4W	1.0
R12	1100-1470	RES-FXD 4.7K 5% 1/4W	1.0
R11	1100-2100	RES-FXD 10K 5% 1/4W	1.0
S9	3015-0004	SWITCH-PB, 10 STA-6P	1.0

01700-30010 ASSY-PC,

ANAL FREQ 2ND DIGIT

	PART NO	DESCRIPTION	QTY
R54	1005-2174	RES-FXD 17.4K 0.25% 1/8W MF	1.0
R53	1005-2196	RES-FXD 19.6K 0.25% 1/8W MF	1.0
R52	1005-2226	RES-FXD 22.6K 0.25% 1/8W MF	1.0
R36	1005-2887	RES-FXD 88.7K 0.25% 1/8W MF	1.0
R35	1005-3100	RES-FXD 100K 0.25% 1/8W MF	1.0
R34	1005-3115	RES-FXD 115K 0.25%% 1/8W MF	1.0
R51	1015-2261	RES-FXD 26.1K 1% 1/8W MF	1.0
R50	1015-2316	RES-FXD 31.6K 1% 1/8W MF	1.0
R49	1015-2392	RES-FXD 39.2K 1% 1/8W MF	1.0
R48	1015-2523	RES-FXD 52.3K 1% 1/8W MF	1.0
R47	1015-2787	RES-FXD 78.7K 1% 1/8W MF	1.0
R33	1015-3133	RES-FXD 133K 1% 1/8W MF	1.0
R32, 46	1015-3158	RES-FXD 158K 1% 1/8W MF	2.0
R31	1015-3200	RES-FXD 200K 1% 1/8W MF	1.0
R30	1015-3267	RES-FXD 267K 1% 1/8W MF	1.0
R29	1015-3402	RES-FXD 402K 1% 1/8W MF	1.0
R28	1015-3806	RES-FXD 806K 1% 1/8W MF	1.0
R45	1100-2100	RES-FXD 10K 5% 1/4W	1.0
R44	1100-2120	RES-FXD 12K 5% 1/4W	1.0
R43	1100-2150	RES-FXD 15K 5% 1/4W	1.0
R42	1100-2160	RES-FXD 16K 5% 1/4W	1.0
R41	1100-2180	RES-FXD 18K 5% 1/4W	1.0
R40	1100-2220	RES-FXD 22K 5% 1/4W	1.0
R39	1100-2330	RES-FXD 33K 5% 1/4W	1.0
R38	1100-2510	RES-FXD 51K 5% 1/4W	1.0
R37	1100-2820	RES-FXD 82K 5% 1/4W	1.0
S10	3015-0004	SWITCH-PB, 10 STA-6P	1.0

01700A-30011 ASSY-PC,

ANAL FREQ 3RD DIGIT

	PART NO	DESCRIPTION	QTY
R72	1015-3178	RES-FXD 178K 1% 1/8W MF	1.0
R71	1015-3200	RES-FXD 200K 1% 1/8W MF	1.0
R70	1015-3226	RES-FXD 226K 1% 1/8W MF	1.0
R69	1015-3267	RES-FXD 267K 1% 1/8W MF	1.0
R68	1015-3324	RES-FXD 324K 1% 1/8W MF	1.0
R63	1015-3887	RES-FXD 887K 1% 1/8W MF	1.0
R62	1015-4100	RES-FXD 1M 1% 1/8W MF	1.0
R67	1100-3390	RES-FXD 390K 5% 1/4W	1.0
R66	1100-3560	RES-FXD 560K 5% 1/4W	1.0
R65	1100-3820	RES-FXD 820K 5% 1/4W	1.0
R61	1100-4110	RES-FXD 1.1M 5% 1/4W	1.0
R60	1100-4130	RES-FXD 1.3M 5% 1/4W	1.0
R59, 64	1100-4160	RES-FXD 1.6M 5% 1/4W	2.0
R58	1100-4200	RES-FXD 2M 5% 1/4W	1.0
R57	1100-4270	RES-FXD 2.7M 5% 1/5W	1.0
R56	1100-4390	RES-FXD 3.9M 5% 1/4W	1.0
R55	1100-4820	RES-FXD 8.2M 5% 1/4W	1.0
S11	3015-0004	SWITCH-PB, 10 STA-6P	1.0

01700-30006 ASSY-PC, ANALYZER

REV B

	PART NO	DESCRIPTION	QTY
Q301, 303, 305	0000-0001	TRANS 2N3644 PNP SI	3.0
Q102, 302, 304	0005-0000	TRANS 2N3053 NPN SI	3.0
Q104	0005-0002	TRANS 2N4996 NPN SI	1.0
Q102, 103	0020-0000	TRANS-FET MEM511C MOS P-CHAN	2.0
U107, 302, 306	0100-0000	IC-COMPARATOR 710	3.0
U105, 106, 304, 305, 308 309, 311, 312, 313, 314	0100-0001	IC-OP AMP 741	10.0
U303, 307, 310	0100-0002	IC-BAL MOD/DEMOD 1496	3.0
U104, 204	0100-0003	IC-OP AMP 2625	2.0
U103	0100-0006	IC-OP AMP 2605 GRADE 1	1.0
U101, 102	0100-0008	IC-OP AMP 2605 GRADE 3	2.0
U201, 202	0100-0009	IC-OP AMP 2605 GRADE 4	2.0
U203, 301	0100-0010	IC-OP AMP 2605 GRADE 5	2.0
CR101-108, 109-116, 119, 121, 201-204, 303, 306	0200-0000	DIODE-GEN 1N914A SI	24.0
CR117, 118	0205-0000	DIODE-ZENER 1N755 7.5V	2.0
CR304, 305	0205-0001	DIODE-ZENER 1N963A 12V	2.0
U205	0305-0001	PHOTOCELL-LED GRADE 1	1.0
U206, 207, 208	0305-0004	PHOTOCELL-LED GRADE 4	3.0
R115, 116	1005-1422	RES-FXD 4.22K 0.25% 1/8W MF	2.0
R121-124	1005-2100	RES-FXD 10K 0.25% 1/8W MF	4.0
R209	1005-2158	RES-FXD 15.8K 0.25% 1/8W MF	1.0
R206	1005-2796	RES-FXD 79.6K 0.25% 1/8W MF	1.0
R158, 159	1015-0010	RES-FXD 10 1% 1/8W MF	2.0
R147, 236, 238	1015-0021	RES-FXD 21.5 1% 1/8W MF	3.0
R240	1015-0056	RES-FXD 56.2 1% 1/8W MF	1.0
R148	1015-0090	RES-FXD 90.9 1% 1/8W MF	1.0
R323	1015-0402	RES-FXD 402 1% 1/8W MF	1.0
R126, 128, 201,325,332,349	1015-1100	RES-FXD 1K 1% 1/8W MF	6.0
R202, 326	1015-1121	RES-FXD 1.21K 1% 1/8W MF	2.0
R235, 324	1015-1200	RES-FXD 2K 1% 1/8W MF	2.0
R165	1015-1280	RES-FXD 2.8K 1% 1/8W MF	1.0
R311, 313, 336,338,353,355	1015-1392	RES-FXD 3.92K 1% 1/8W MF	6.0
R166, 314, 335, 352	1015-1715	RES-FXD 7.15K 1% 1/8W MF	4.0
R161, 162, 163	1015-1750	RES-FXD 7.5K 1% 1/8W MF	3.0
R127, 212	1015-1909	RES-FXD 9.09K 1% 1/8W MF	2.0
R145, 204, 205,207,208,216	1015-2100	RES-FXD 10K 1% 1/8W MF	6.0
R215	1015-2475	RES-FXD 47.5K 1% 1/8W MF	1.0
R164	1015-2499	RES-FXD 49.9K 1% 1/8W MF	1.0
R343, 368	1100-0010	RES-FXD 10 5% 1/4W	2.0
R156	1100-0022	RES-FXD 22 5% 1/4W	1.0
R150, 152, 153, 203, 303, 304, 327	1100-0100	RES-FXD 100 5% 1/4W	7.0
R155, 365	1100-0180	RES-FXD 180 5% 1/4W	2.0
R318	1100-0270	RES-FXD 270 5% 1/4W	1.0
R246, 247, 320, 362	1100-0330	RES-FXD 330 5% 1/4W	4.0
R139, 366	1100-0510	RES-FXD 510 5% 1/4W	2.0
R136, 151, 167, 243, 245 310, 316, 344, 360	1100-1100	RES-FXD 1K 5% 1/4W	9.0
R214, 333, 334	1100-1150	RES-FXD 1.5K 5% 1/4W	3.0
R339, 357, 361	1100-1200	RES-FXD 2K 5% 1/4W	3.0
R211, 305, 306, 324, 328, 345, 346, 359	1100-1220	RES-FXD 2.2K 5% 1/4W	8.0
R322	1100-1270	RES-FXD 2.7K 5% 1/4W	1.0
R321	1100-1330	RES-FXD 3.3K 5% 1/4W	1.0
R135, 315, 340, 356	1100-1390	RES-FXD 3.9K 5% 1/4W	4.0
R113, 114, 133, 137, 350	1100-1510	RES-FXD 5.1K 5% 1/4W	5.0
R132, 168, 307, 308, 317 319, 330, 331, 342, 347 348, 358, 363, 367	1100-2100	RES-FXD 10K 5% 1/4W	14.0

01700-30006 ASSY-PC, ANALYZER (CONT)

REV B

	PART NO	DESCRIPTION	QTY
R134, 242, 244	1100-2150	RES-FXD 15K 5% 1/4W	3.0
R213	1100-2180	RES-FXD 18K 5% 1/4W	1.0
R210	1100-2330	RES-FXD 33K 5% 1/4W	1.0
R341	1100-2390	RES-FXD 39K 5% 1/4W	1.0
R130, 131, 138, 301, 302	1100-3100	RES-FXD 100K 5% 1/4W	5.0
R149, 154, 169	1100-4100	RES-FXD 1M 5% 1/4W	3.0
R111, 112	1200-2000	RES-FXD 500 3W WW	2.0
R157, 239, 312, 337, 359	1410-0001	RES-VAR 100 TRIMPOT CERMET	5.0
R146, 237, 364	1410-0003	RES-VAR 1K TRIMPOT CERMET	3.0
R129, 217, 234	1410-0005	RES-VAR 100K TRIMPOT CERMET	3.0
R351	1410-0007	RES-VAR 20K TRIMPOT CERMET	1.0
C103, 106, 108, 111, 201, 205, 206, 309, 317	2000-0010	CAP-FXD 10PF 5% 500V MICA	9.0
C203	2000-0022	CAP-FXD 22PF 5% 500V MICA	1.0
C106, 107	2000-0027	CAP-FXD 27PF 5% 500V MICA	2.0
C320	2000-0047	CAP-FXD 47PF 5% 500V MICA	1.0
C128	2000-0051	CAP-FXD 51PF 5% 500V MICA	1.0
C104, 105, 110, 124, 148, 202, 204, 207, 212	2000-0056	CAP-FXD 56PF 5% 500V MICA	9.0
C211	2000-0082	CAP-FXD 82PF 5% 500V MICA	1.0
C345, 346	2000-0100	CAP-FXD 100PF 5% 500V MICA	2.0
C112, 113, 114, 115	2000-0270	CAP-FXD 270PF 5% 500V MICA	4.0
C130	2000-0360	CAP-FXD 360PF 5% 500V MICA	1.0
C129	2000-0910	CAP-FXD 910PF 5% 500V MICA	1.0
C311, 322	2020-0001	CAP-FXD 0.022UF 10% 100V MYLAR	2.0
C121	2020-0003	CAP-FXD 0.1UF 10% 100V MYLAR	1.0
C131, 132, 133	2025-0010	CAP-FXD .039UF 2.5% 33V PLYSTR	3.0
C134-139, 142-147, 213-218, 321, 327, 328, 331-334 337-344, 347-350	2040-0000	CAP-FXD 0.01UF 100V CERAMIC	39.0
C140, 141, 219, 220, 325, 326, 329, 330	2040-0002	CAP-FXD 0.1UF 25V CERAMIC	8.0
C310	2100-0001	CAP-FXD 1UF 25V ELECT AL	1.0
C120, 127, 302, 303, 306 307, 316, 318	2100-0004	CAP-FXD 35UF 25V ELECT AL	8.0
C125, 126,304,305,308,319	2100-0006	CAP-FXD 100UF 25V ELECT AL	6.0
C208, 209	2100-0007	CAP-FXD 200UF 25V ELECT AL	2.0
S101, 102	3015-0000	SWITCH-PB, 2 STA-2P, P-P	1.0
S103-106	3015-0001	SWITCH-PB 4 STA(1 SPACE)-2P	1.0

01700-30014 INPUT SWITCH ASSEMBLY

	PART NO	DESCRIPTION	QTY
R144	1000-0001	RES-FXD 102 0.1% 1/8W	1.0
R118	1000-0002	RES-FXD 953 0.1% 1/8W	1.0
R117	1000-0003	RES-FXD 3.92K 0.1% 1/8W	1.0
R143	1005-0221	RES-FXD 221 0.25% 1/8W MF	1.0
R142	1005-0698	RES-FXD 698 0.25% 1/8W MF	1.0
R105, 110	1005-1102	RES-FXD 1.02K 0.25% 1/8W MF	2.0
R104, 109, 141	1005-1221	RES-FXD 2.21K 0.25% 1/8W MF	3.0
R103, 108, 142	1005-1698	RES-FXD 6.98K 0.25% 1/8W MF	3.0
R102, 107	1007-2221	RES-FXD 22.1K 0.25% 1/2W MF	2.0
R101, 106	1008-2698	RES-FXD 69.8K 0.25% 1W MF	2.0
R117	1100-2560	RES-FXD 56K 5% 1/4W	1.0
R119	1100-3910	RES-FXD 910K 5% 1/4W	1.0
C116, 118	2000-0005	CAP-FXD 5PF 10% 500V MICA	2.0
S1	3010-0001	SWITCH-ROTARY, INPUT 1700A	1.0

01700-30015 RATIO SWITCH ASSEMBLY

	PART NO	DESCRIPTION	QTY
R232	1005-0475	RES-FXD 475 0.25% 1/8W MF	1.0
R226-231	1005-0690	RES-FXD 690 0.25% 1/8W MF	6.0
R219-225	1005-1102	RES-FXD 1.02K 0.25% 1/8W MF	7.0
R233	1015-2681	RES-FXD 68.1K 1% 1/8W MF	1.0
R218	1100-0360	RES-FXD 360 5% 1/4W	1.0
C312, 323	2100-0001	CAP-FXD 1UF 25V ELECT AL	2.0
C313, 324	2100-0003	CAP-FXD 10UF 25V ELECT AL	2.0
C314, 315, 325, 326	2100-0006	CAP-FXD 100UF 25V ELECT AL	4.0
S2	3010-0000	SWITCH-ROTARY, RATIO 1700A	1.0

SOUND TECHNOLOGY
1400 DELL AVENUE
CAMPBELL, CALIFORNIA 95008
(408) 378-6540

Model 1700A
Serials Prefixed: ~~104-~~ 105-

ERRATA

We recommend that immediately upon receipt of the attached manual, the user pencil-in the changes listed below ~~as well as the changes described on the third sheet in the manual~~.

Location	As appears in manual	As should read
Page 1-2, Para. t.	109.0 KHz	109.9 KHz
Page 1-3, Para. 1-8 a.	1800A	1700A
Page 1-3, Para. 1-9 (1)	300 B Below 60 Hz	300 V Below 60 Hz
Page 1-5, Para. 1-10	...TO PRECENT BLOWING...	...TO PREVENT BLOWING...
Page 1-7, Para. 1-14 h.	Set 1700A frequency or pushbutton on external oscillator so both...	Set 1700A frequency or external oscillator frequency so both...
Page 1-8, Para. 1-16 d.	Full Scale Sensitivity 30 mV 100 mV 300 mV 1 mV	Full Scale Sensitivity 30 µV 100 µV 300 µV 1 mV
Page 2-5, Para. 2-18 c.	The high-speed loop,...	The low-speed loop,...
Page 3-1, Para. 3-6 b.	OSCILLATOR LEVEL control---fully CCW	---fully CW (max. level)
Page 3-14, PROBABLE CAUSE	Range capacitor (s) or digit resistor (s) drifted out of in analyzer section	Range capacitor (s) or digit resistor (s) drifted out of tolerance in analyzer section

On page 2-2, section 2-7 should read as follows:

The output of the notch filter is coupled through a 7-step attenuator to the input of distortion amplifier U204. The attenuator is controlled by section S2D of the front panel RATIO switch and reduces the distortion product of the notch filter such that the full scale voltage input to the amplifier is 1 mV on ranges .03% through 100% and .316 mV on the .01% range.

Amplifier U204 is a wide-band high-gain unit with gain controlled by section S2E of the RATIO switch. The gain is 31.6 for ranges .03% through 100% and 100 for the .01% range. This gives a full scale output voltage of 31.6 mV on all ranges.

Two 3AG 1 amp fuses are installed in 1700A's with serial prefixes 104 and above. These fuses are intended to protect the 1700A from possible damage resulting if connection is made to a hot chassis. If the 1700A appears to be malfunctioning check to see if these fuses are blown. The fuses may be accessed by removing the bottom cover of the 1700A.